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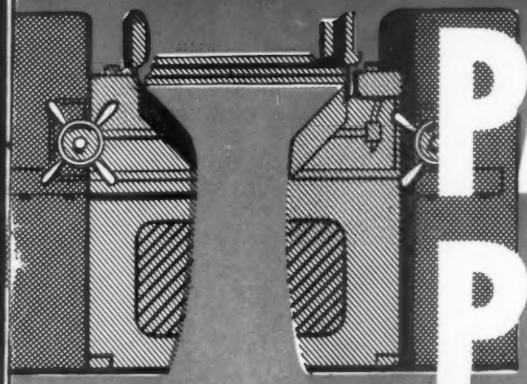

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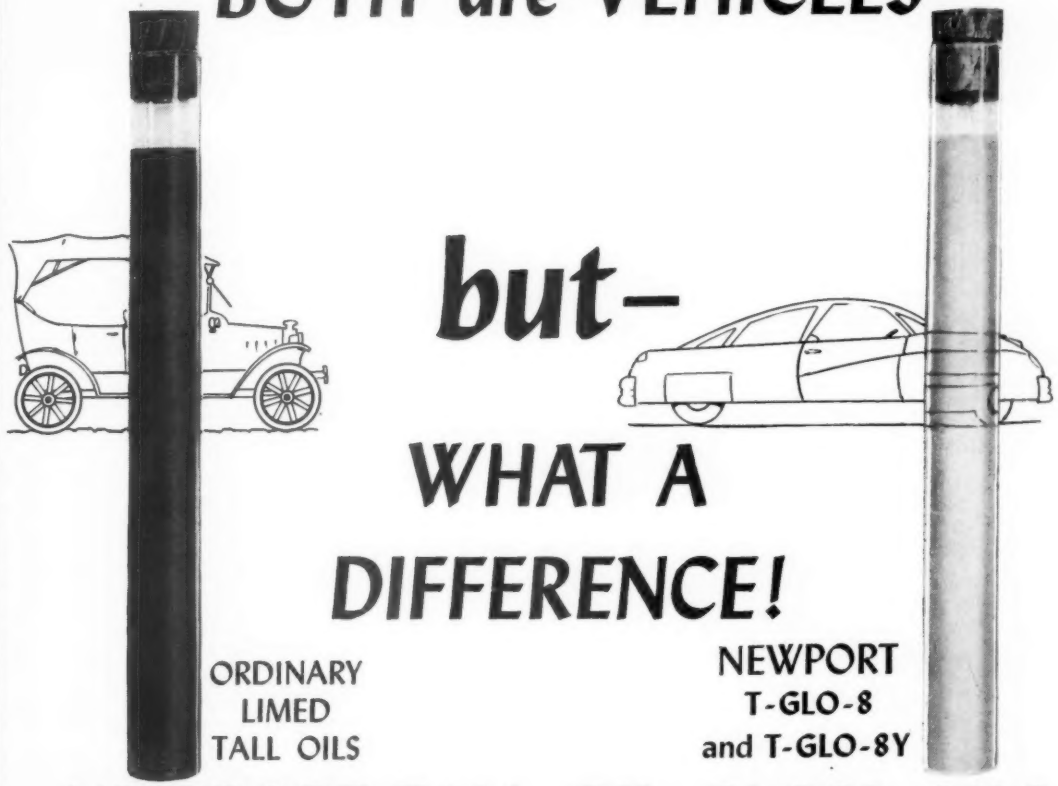

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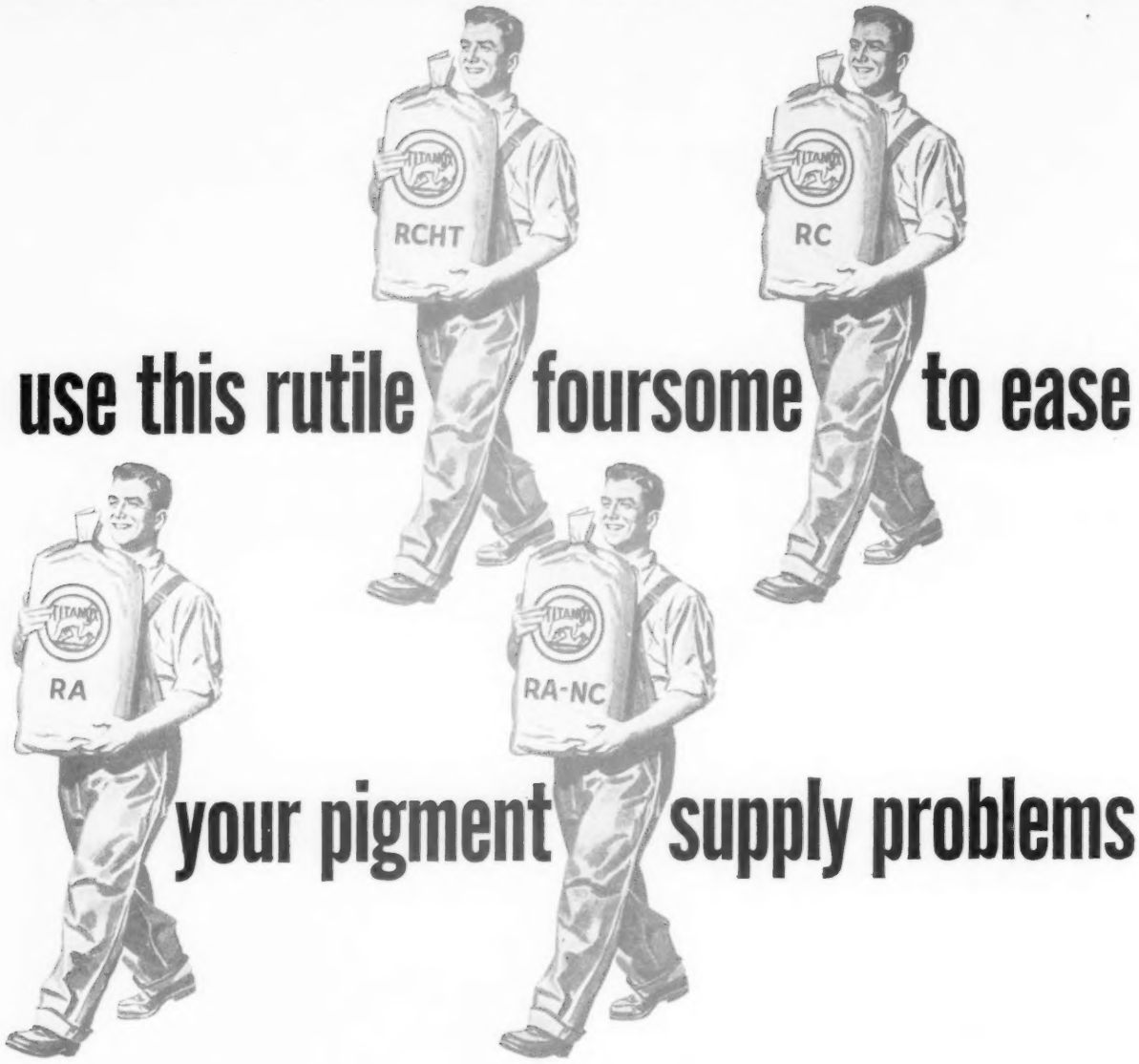

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NEXT ISSUE

Commencing with the February issue of Paint and Varnish Production we will carry an interesting series of articles on the use of vinyl resins in surface coating materials. The object of this series is to acquaint the formulator with the properties of these resins, methods of formulation and the performance of vinyl polymer based coatings.

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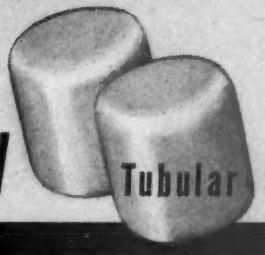

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Borundum grinds faster because it is twice as heavy as flint pebbles . . . and more than twice as hard. (Borundum is almost as hard as a diamond, can only be cut with a diamond wheel.)

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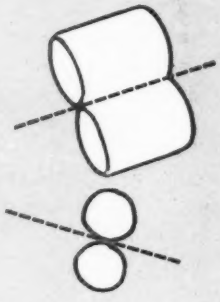

READ THIS REPORT

FROM A PROMINENT PAINT MANUFACTURER

PROCEDURE: Two (2) 25-Gal. Mills were used of the same shape, capacity and speed of rotation. Mill "A" was filled with "BORUNDUM" and Mill "B" with Flint Pebbles. An identical volume of these two (2) grinding media was placed into each test mill. Similarly, the same solution was then ground in each mill.
GRINDING EFFICIENCY: This was determined by readings taken on a "North" Gage for the fineness of grinding after a predetermined number of hours.

TEST 1 — GREEN TINTING SOLUTION: Number of hours required to grind this test solution to a reading of "7" on the "North" Gage —		TEST 2 — ZINC CHROMATE (Yellow): Number of hours required to grind this test solution to a reading of "6" on the "North" Gage —		TEST 3 — GRAY MINITNAMEL: Number of hours required to grind this test solution to a reading of "7" plus on the "North" Gage —	
"BORUNDUM"	Flint Pebbles	"BORUNDUM"	Flint Pebbles	"BORUNDUM"	Flint Pebbles
44	76	44	90	42	80

RESULTS: Note that in each case, "BORUNDUM" performed a comparable grinding job in approximately 50% less time than with Flint Pebbles.

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Please ship us 15 lbs. (enough to charge a 1-gallon mill jar) of Borundum. Bill us at 63c per pound, plus shipping costs on our purchase order No._____

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Company_____

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PROCESS EQUIPMENT DIVISION

Editorial Comment

A Job Well Done

SOME two years ago the National Paint, Varnish and Lacquer Association launched an advertising program designed to bring to the readers' attention the importance of paint around the home and their use in product finishing.

In commenting on this program, President Joseph F. Battley stated at the recent convention in San Francisco that every phase and every member of the paint industry has benefited by this program. Certainly much credit for increased sales must be given to the advertising publicity and promotion which have told consumers about quality paints and sold color by suggesting its use.

There is no doubt that this advertising program has helped to boost paint sales beyond the billion dollar mark. It has stimulated the interest of home-owners and industrial management in paint. It has showed the consumer the necessity of painting; not only as a means of protection but as a means of beautifying property.

Similarly industrial finishes have been given considerable attention in this program. The general theme of higher quality with lower production cost will be featured in the industrial trade publication during this year's campaign. Specific cases will be shown where engineered finishes have lowered costs and added to consumer acceptance. As was pointed out by Kustave Klinkenstein, newspaper and radio programs have contributed much to a better understanding of the part that quality finishes play in our daily lives. More manufacturers are stressing the finish on their products in national advertising. This can be credited to the Associations advertising program and the promotions which have put into motion.

This program is dedicated to reach as many people as possible and when one adds up the number of impressions made, it is staggering.

According to Val Wurtele of Minnesota Paints, 52 million readers are reached through 21 magazines. Newspapers have an audience of 87 million readers. Radio stations have 38 million listeners. This adds up to 177 million people exposed to the industry's story on paints and finishes. This is not one—but weekly in the case of newspapers; twice a month in the case of radio stations and during the peak season for magazines.

To this must be added the tremendous influence of national magazines with their articles on color and home decoration. They have had a great deal to do with making the public more conscious of the beauty resulting from painting.

Then there are the very effective window displays tieing in with the national advertising at the point of sale. All this helps to sell paint in one form or another.

Russel G. Dahlberg who spoke on trade sales said that at the end of two years the intensive paint publicity campaign has reached a momentum that is being reflected in dollars and cents. This compelling force will accelerate in effectiveness as it continues into next year. It is almost needless to say that its impact will become increasingly greater in building paint sales to high levels.

This cooperative program is a good example of what advertising can do for a particular industry. In the case of our industry, raw material suppliers, manufacturers, retail dealers, painting contractors, wholesalers, and those dealing in industrial finishers have all benefit by it. For the consumer it has meant an education. It has shown him how to use color and how to get the most out of it. It has given him advise as to the proper use of paints and the proper methods of surface preparation and application.

All in all this program has been a huge success. We wish to take this opportunity to congratulate the National Paint, Varnish and Lacquer Association on a job well done.

Angle iron specimens are exposed to atmospheric exposure on 45 degree rack facing south. (Figure 2).

Metal Protective RED LEAD PAINTS

C. J. VANDER VALK,
Lead Industries Association

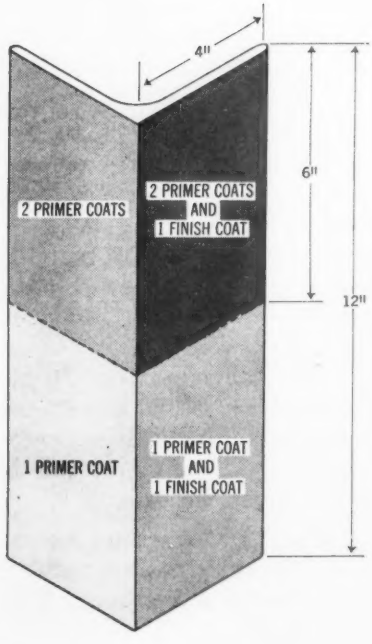

Fig. 1. Diagram shows arrangement of single & multiple coat systems on 4" × 4" × 3/8" angle iron.

ONE purpose of this article is to provide the latest information on red lead pigmented formulations which are specified by governmental and industrial users. Another object is to make available some of the latest work on red lead base paints in which some of the newer types of vehicles are utilized.

Effective use of paint for the protection of iron and steel requires that they provide a tightly bound mechanical barrier against surrounding corrosive influences and also to keep the metal base in a passive state when corrosive agents penetrate the coating. The reactivity of red lead with glycerides of drying oils to form insoluble metallic soap complexes greatly enhances the effectiveness of paints as mechanical barriers by increasing their water impermeability and toughness. In addition, red lead because of its unique chemical composition effectively inhibits the anodic solution of steel through its oxidizing character and buffering action. This property is also important in minimizing the acidity resulting from the decomposition of oleoresinous binders which occurs on weathering.

Specification Formulas

THE problems of corrosion protection and paint formulation are complex and no single type of paint will give the best protection under all conditions. Specification paints

are now available to cope with a wide range of exposure conditions and to satisfy diversified technical and economic demands. Included in these specifications are formulas composed of pure red lead and multiple pigmentations in oil, synthetic, and oil extended synthetic vehicles. Only a few lately established anticorrosive paint specifications are discussed in this article. There are numerous additional high quality red lead specifications in use by municipal, state and federal agencies. The specifications are presented in this article to illustrate the progress made through the intelligent application of newer raw materials. This has been accomplished through the close cooperation of the raw materials manufacturer, the paint producer and the specification writer. These specifications represent many years of research and practical experience.

Fig. 3. Three outstanding systems containing Paints Nos. 35, 36, 37 respectively, after 78 months 45 degree exposure at Sayville, L. I.

Red Lead-Linseed Oil Type. Where very thorough surface preparation cannot be assured and where quick drying is not a requisite, red lead-linseed oil paints are found to be most effective. The penetrating quality of linseed oil enables wetting of the underlying metal which results in intimate bonding of paint and steel despite the presence of small amounts of surface corrosion products. The most widely used of this type contain straight red lead pigmentations. They are well suited as shop coats or field applied priming and intermediate coats for structural steel exposed to atmospheric conditions. The reliability and long protective life of this type of paint has resulted in its wide adoption by state and federal agencies for initial and maintenance painting of bridges, tanks, steel building members, concrete reinforcements, fences and other applications.

A paint conforming to Type I of Federal Specification TT-P-86a is an excellent example of the red lead-linseed oil class. A formula for such a paint is shown in Table I. Red lead paints similar or identical to this are widely used by state highway departments, federal agencies, municipalities, railroads, steel fabricators, public utilities and industry. Most industry associations interested in the preservation of iron and steel recommend red lead base paints. The American Water Works Association and the American Assn. of State Highway Officials are examples of such groups.

Faster Drying Type. In certain cases, for reasons of expediency or to meet production schedules the use of faster drying anticorrosive paints is necessary. This requirement has been successfully met with the development of carefully designed red lead paint formulations utilizing synthetic resins in the vehicle.

Among the most widely used types of faster drying red lead base paints are those made with glyceryl phthalate alkyd resins, containing fifty to sixty percent fatty acid glycerides, or phenolic varnishes consisting of oil soluble type resins cooked into linseed, tung or other drying oils. As a class, these faster drying primers containing synthetic varnish vehicles perform best when applied to metal freed of all surface contaminants. This is due to fast setting characteristics of these paints which retards penetration through rust and foreign matter to the base metal.

Synthetic-Linseed Type. Where work schedules call for an overnight dry and complete removal of rust and mill scale is not feasible, a primer

Fig. 4. Panels suspended about 3 feet above high tide level in marine basin at Sayville.

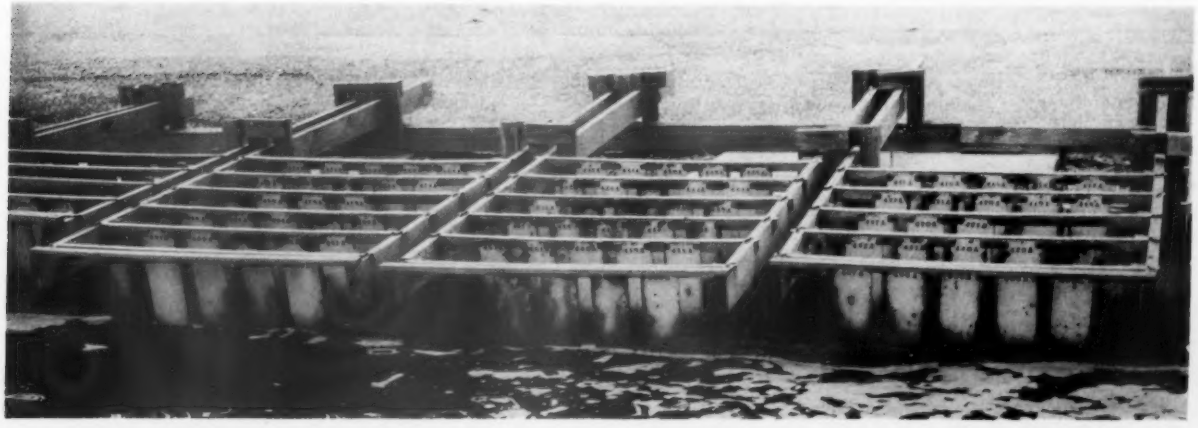

TABLE 1

Typical Specification Formulas
Red Lead Base Paints

Designation	Suggested Uses	Formulation					Time Required Before Recoating
		Ingredient	% by wt.	Pounds	Gallons	Properties	
Federal Specification TT-P-86a, Type I	General structural steel priming, shop and field.*	Pigment	77.7			lb/gal. . . 24.3	36 hours
		Red Lead (97% grade)	99.6	1885.0	25.50	PV 36	
		Aluminum Stearate	0.4	7.5	0.90		
			100.0				
(May 4, 1949)		Vehicle	22.3				
		Raw Linseed Oil	49.0	266.0	34.30		
		Pale Heat Bodied Linseed Oil	17.0	92.4	11.50		
		Mineral Spirits	29.0	157.4	24.00		
		Liquid Drier	5.0	27.2	3.80		
			100.0	2435.5	100.00		
Federal Specification TT-P-86a, Type II	Structural steel priming and body coats, shop or field, can be recoated in 16 hours.	Pigment	66.0				
		Red Lead (97% grade)	65.0	716.0	9.70	lb/gal. . . 16.7	16 hours
		Red Iron Oxide (85% Fe_2O_3)	15.0	165.0	4.40	PV 38	
		Magnesium Silicate	14.7	162.0	6.80		
(May 4, 1949)		Mica, 325 mesh	5.0	55.0	2.30		
		Aluminum Stearate	0.3	3.3	0.40		
			100.0				
		Vehicle	34.0				
		Alkyd Resin Solution	56.0	318.0	42.40		
		Raw Linseed Oil	28.0	160.0	20.60		
		Mineral Spirits	15.1	84.7	12.80		
		Lead Naphthenate (24% Pb)	0.6	4.2	0.40		
		Cobalt Naphthenate (6% Co)	0.3	1.8	0.20		
			100.0	1670.0	100.00		
Federal Specification TT-P-86a, Type III	Priming sand blasted structural steel, factory finished articles.	Pigment	67.3				
		Red Lead (97% grade)	99.7	1275.0	17.20	lb/gal. . . 19.0	6 hours
		Aluminum Stearate	0.3	3.5	0.46	PV 38	
			100.0				
(May 4, 1949)		Vehicle	32.7				
		Alkyd Resin Solution	84.0	522.5	67.50		
		Aromatic Petroleum Spirits	14.5	90.0	13.70		
		Cobalt Naphthenate (6% Co)	0.3	1.9	0.20		
		Antioxidants and wetting agents	1.2	7.6	0.94		
			100.0	1900.5	100.00		
Federal Specification TT-P-86a, Type IV	Priming, body and finish coats for surfaces totally immersed in fresh water.**	Pigment	65.9				
		Red Lead (97% grade)	85.0	950.0	12.85	lb/gal. . . 17.0	6 hours
		Diatomaceous Silica	8.0	89.6	5.36	PV 41	
		Magnesium Silicate	6.6	74.0	3.10		
(May 4, 1949)		Aluminum Stearate	0.4	4.4	0.53		
			100.0				
		Vehicle	34.1				
		Phenolic Varnish	74.0	432.0	57.70		
		Aromatic Petroleum Spirits	22.4	129.7	17.70		
		Dipentine	2.75	16.0	2.26		
		Antioxidants	0.5	2.2	0.27		
		Lead Naphthenate	0.23	1.4	0.15		
		Cobalt Naphthenate	0.06	0.3	0.04		
		Manganese Naphthenate	0.06	0.3	0.04		
			100.0	1699.9	100.00		
Bureau of Ships Paint Formula No. 116	Maintenance painting for topsides of ships.	Pigment	52.0				
		Red Lead (97% grade)	55.0	380.0	5.13	lb/gal. . . 13.3	6 hours
		Zinc Yellow	10.1	70.0	2.33	PV 30	
		Mica	9.4	65.0	2.77		
		Indian Red	1.5	10.0	0.23		
(June 1, 1949)		Magnesium Silicate	23.1	160.0	6.70		
		Aluminum Stearate	0.9	6.0	0.71		
			100.0				
		Vehicle	48.0				
		Alkyd Resin Solution	64.9	415.0	52.00		
		Dipentine	3.9	25.0	3.52		
		Petroleum Spirits	29.6	190.0	29.20		
		Lead Naphthenate (24% Pb)	0.8	4.7	0.49		
		Cobalt Naphthenate (6% Co)	0.8	4.7	0.59		
			100.0	1330.4	103.67		

TABLE I (*Continued*)

Designation	Suggested Uses	Ingredient	Formulation % by wt.	Pounds	Gallons	Properties	Time Required Before Recoating
U. S. Maritime Commission Specification 52-MC-201 (March 8, 1946)	Designed for application on clean bare steel. For painting ships, docks and other structures exposed to marine atmospheres.	Pigment	52.0				
		Red Lead (97% grade)	55.4	380.0	5.14	lb/gal. .. 13.2	6 hours
		Zinc Yellow	10.2	70.0	2.31	PV 33	
		Mica	9.4	65.0	2.41		
		Indian Red	1.4	10.0	0.20		
		Magnesium Silicate	23.3	160.0	6.70		
		Aluminum Stearate	0.3	2.0	0.24		
			100.0				
		Vehicle	48.0				
		Alkyd Resin Solution	66.0	415.0	52.00		
		Aromatic Naphtha	16.7	105.0	14.00		
		Petroleum Spirits	17.3	110.0	17.00		
			100.0	1317.0	100.00		

* Included in Tentative Recommended Practice of the American Water Works Association for the priming of water tank exteriors.
** Included in Tentative Recommended Practice of the American Water Works Association for the priming of water tank interiors.

containing a blend of synthetic resin and free linseed oil has proven to be a successful compromise. As an example, by using a blend of linseed oil and alkyd resin the advantages of each can be partially realized.

Since the vehicle in this paint is a compromise, its wetting and penetrating characteristics are limited. Consequently it should only be applied to surfaces freed of loose mill scale and corrosion products. The formula in Table I conforming to type II of the Federal Specification TT-P-86a, serves as an excellent example of such a primer. It is suitable for shop or field priming and body coats on structural steel. The paint is intended for use where painting schedules require handling and recoating in less than twenty-four hours.

This paint also exemplifies the use of red lead in mixed pigment formulations. The ability of red lead with vehicles to form reinforcing organic lead compounds coupled with its strong corrosion inhibitive characteristics make it particularly suitable for multi-pigment anticorrosive paints.

Multiple pigment paints are often indicated for special service conditions where dependable protection is sought at reduced initial cost.

Red Lead-Synthetic Vehicle. The advantages of red lead in fast drying paints are realized by utilizing vehicles containing the higher polymer synthetic binders. Such vehicles impart a higher degree of water impermeability and chemical resistance.

It is essential that paints of this type be applied to exceptionally clean surfaces, since due to their fast drying properties and reduced oil content, they do not have the surface wetting properties which characterize paints containing free linseed oil. An example of a fast drying red lead paint is one conforming to Type III of Federal Specification TT-P-86a. The formula of such a paint is presented in Table I. It is intended for use in painting thoroughly clean iron and steel surfaces for general maintenance and touch-up where drying within a 6 hour period is desired. Paints based on this specification are used on transformers, window sash, air conditioning ducts, railroad cars, storage tanks and structural steel members.

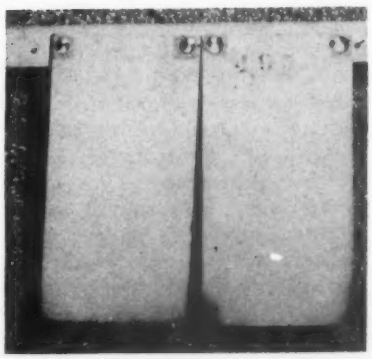

Fig. 5. Two outstanding systems for marine atmospheric exposure after being vertically exposed 30 inches above high tide for 55 mos.

Water & Chemical Resistance

A LONG term protection of ferrous surfaces continuously immersed in fresh water is among the most trying paint problems of water works officials and engineers. The waters vary in mineral content and cover a range of pH. Submerged portions of dams, bridges and dock structures are often located in contaminated waters and are buffeted by floating debris, suspended silt and ice.

A paint complying to Type IV of Federal Specification TT-P-86a is particularly well adapted for fresh water immersion. Such a formula conforming with the requirements of the specification is shown in Table I. This is a fast, hard drying red lead base paint incorporating a highly water impermeable and chemically resistant spar varnish vehicle. This paint is included in the recommended practice of the American Water Works Association for the priming of water storage tank interiors. Although this paint was especially designed for total immersion in fresh water, it also has excellent chemical resistance and can be used successfully to protect ferrous surfaces in highly alkaline or acid environments such as are encountered in chemical process plants, laundries, textile plants, smelters and mines.

As with all primers containing a synthetic binder, the best protective performance cannot be assured unless the paint is applied over thor-

oughly cleaned surfaces. The removal of all corrosion products, mill scale and greasy matter before application of the priming coat is equal in importance to the use of a high quality corrosion inhibitive paint.

Marine Applications

MUCH research and test work has been carried out in recent years on paints for marine applications, including ships and other structures exposed to salt water and saline environments. These intensive investigations have been conducted in cooperation with many private companies and government agencies.

Two marine primers for the atmospherically exposed areas of ships worthy of special attention are Bureau of Ships Formula No. 116 and Maritime Commission Specification 52-MC-201 formula. It can be seen from Table I that these formulas are similar in composition and both contain red lead base mixed pigmentations in alkyd resin vehicles. Both vehicles consist of long oil length glyceryl phthalate alkyds—a soya oil modification in the Bureau of Ships formula and a linseed modification in the Maritime Commission Specification formula. Both primers dry fast enough to permit recoating in six hours under normal drying conditions.

When applied over sound surfaces to a thickness of at least three mils, either of these primer paints forms an excellent protective foundation for all parts of ships above the water line. For new construction two coats of these paints applied to exterior and interior surfaces offer an excellent base for subsequent finishing coats. They have good compatibility with oleoresinous type exterior finish paints as well as with interior enamels. For maintenance, base areas can be spot primed and followed by a full coat application of primer before application of the finish coats. Such a painting system should result in considerably reduced maintenance costs.

Vinyl Coatings

A RED lead pigmented vinyl chloride—acetate anticorrosive paint is being used extensively in a system comprising a wash primer—surface conditioner, red lead—vinyl anticorrosive paint and a suitable vinyl type finish coat. Several government agencies have prepared specifications covering these vinyl type paints. Systems utilizing these coating materials have shown excellent performance on ship bottoms, on surfaces subjected to immersion in fresh water and for service in chemically contaminated environments.

Recent Studies

THE Lead Industries Association continues to investigate all types of red lead paints, keeping abreast of the latest developments in raw materials and expanding needs of industry. Service exposures of thousands of specimens during the past several years have resulted in the development of several outstanding corrosion-inhibitive paint formulations. These projects have been carried out under a variety of exposure conditions including inland and marine atmospheres and immersion in sea water.

The general object of these projects is the development of improved metal protective paints for the construction, steel fabricating and shipbuilding industries and for those responsible for the economical maintenance of structures and vessels in service. To accomplish this objective it was necessary to give special consideration to adjustments in formulation of red lead paints to enable them to cope more satisfactorily with various environmental conditions. Among the factors investigated were:

1) the influence of other pigments, both as to kind and proportion.

2) the selection of the best types of synthetic vehicles to meet varied drying requirements and to provide maximum service life.

Paint Systems. In view of the variable usage of primer paints, four systems were used for more completely evaluating coatings intended for atmospheric exposure. These comprised one and two coats of primer paint without a finish paint and one and two coats of primer with a durable finish paint. Examples of single primer coat applications are the general shopcoating of structural steel and of steel for subsequent enclosure in concrete. Iron and steel structures designed for direct exposure to the natural environment require multiple paint systems, comprising at least two red lead primer coats plus one or more suitable finish coats.

The paints involved in the atmospheric exposure test were applied to 1 foot lengths of $4'' \times 4'' \times \frac{3}{8}''$ thick angle iron shapes carrying mill scale. Surface preparation was limited to thorough wire brushing and solvent cleaning, thus assuring removal of rust, loose mill scale and greasy matter but leaving the tightly adherent mill scale on the base specimen. This procedure represents an effective way of coping with a common surface condition encountered in practice. The paint systems were applied according to the scheme illustrated in Figure 1.

The primer paints considered in this discussion are from one project. They were designed to dry fast and were consequently made with resin type binders only. They were applied by brushing at normal spreading rates.

Atmospheric Exposure

Inland. The inland atmospheric exposure project referred to in this article is being carried on at the Atmospheric Exposure Station at Sayville, Long Island, New York. This station is located about fifty miles east of New York City. The racks are of the forty-five degree type facing south and are located in a rural environment one mile inland from Great South Bay. A photograph of the forty-five degree racks at Sayville is shown in Figure 2. This illustrates the method of placing the specimens at an angle of forty-five degrees to the horizontal for maximum exposure to sun light.

78 Months. The three lead primers which have shown outstanding protective performance after seventy-eight months are illustrated in Figure 3. These show the high performance to be expected from properly formulated red lead base paints utilizing fast drying vehicles.

The paint systems consisting of two normal primer coats both with and without the white lead finish paint show no signs of deterioration and are completely free of rust. Although some rust is present in the one coat primer area, most of the surface is still sufficiently preserved to permit repainting without extensive surface preparation. The detailed compositions of these three outstanding red lead paints are given in Table II.

New Primers

ADDITIONAL tests carried out over a fifty-five month period of red lead base pigmentations in synthetic resin vehicles has resulted in the development of several improved paints for exposure to marine atmospheres. These primers are suited for the painting of all parts of ships above the water line, bridges along the coast or over tide waters, docks and dock buildings, machinery in marine installations and interior surfaces exposed to industrial brine solutions.

The paints were applied to 12 gauge 6" by 12" panels from which the mill scale was not removed. The paint systems in this project comprised of two coats of each fast drying red lead primer followed by a single coat of a highly durable gray finish paint. Each coat of paint was applied to a dry film thickness of approximately 1.5 mils.

The painted panels were exposed in a vertical position facing south at approximately three feet above high tide level in the Marine Basin at Sayville, Long Island as illustrated in Figure 4. The close proximity of the test specimens to ocean water subjected them to frequent action of salt spray at all seasons.

After fifty-five months exposure several of these newer type red lead base-synthetic vehicle paint systems showed outstanding performance. They gave virtually complete protection to the steel in a rigorous Atlantic Coast atmosphere and showed practically no signs of deterioration or breakdown. A photograph of specimens containing two of the outstanding systems is shown in Figure 5. Table III contains the detailed composition of these two primer paints.

Table II

Outstanding Red Lead Paint Formulations

Atmospheric Exposure

	Paint No. 35	Paint No. 36	Paint No. 37
% Pigment	63.2	53.3	56.6
Red Lead (97% Grade)	55.0	55.0	55.0
Basic Lead Chromate	-	-	20.0
Zinc Oxide	10.0	10.0	10.0
Zinc Chromate	10.0	10.0	-
Iron Oxide	7.0	7.0	-
Magnesium Silicate	10.0	10.0	10.0
Diatomaceous Silica	8.0	8.0	5.0
	100.0	100.0	100.0
% Vehicle			
Linseed Modified Alkyd Solution*	36.9	-	-
Dehydrated Castor Oil Modified Alkyd Solution**	-	-	75.6
6 Gallon Phenolic Varnishes***	55.1	-	-
Phenolic Modified Alkyd Solution****	-	100.0	-
Thinner & Driers	8.0	-	24.4
	100.0	100.0	100.0
Pounds Per Gallon	16.6	14.4	15.6
Pigment Volume	41%	33%	40%

*Glyceryl Phthalate Alkyd modified with linseed oil, 34% phthalic anhydride on solids, non-volatile content=50%.

**Glyceryl Phthalate Alkyd Modified with dehydrated castor oil, 30% phthalic anhydride on solids, non-volatile content=66%.

***Six Gallon Linseed Oil Varnish containing equal parts of Coumarone-Indene resin (m.p. 127-137°C.) and an alkyl-phenolic resin. Non-Volatile = 56%.

****A phenolic modified linseed oil alkyd of long oil length.

Table III

Outstanding Red Lead Paints

Marine Atmospheric Exposure

	Paint No. 132	Paint No. 183
% Pigment	56.1	55.4
Red Lead (97% Grade)	55.0	70.0
Zinc Oxide	10.0	-
Zinc Chromate	10.0	10.0
Graphitic Mica	-	20.0
Mica (325 Mesh)	25.0	-
	100.0	100.0
% Vehicle	44.6	43.9
Linseed Modified Alkyd*	29.3	-
Dehydrated Castor Modified Alkyd**	-	76.8
6 Gallon Phenolic Varnish***	44.0	-
Petroleum Spirits	25.2	21.8
Lead Naphthenate Drier	1.2	1.1
Manganese Naphthenate Drier	0.3	0.3
	100.0	100.0
Pounds Per Gallon	14.0	14.5
Pigment Volume	35%	33%

*Glyceryl Phthalate Alkyd modified with linseed oil, 34% phthalic anhydride on solids, non-volatile content=50%.

**Glyceryl Phthalate Alkyd modified with dehydrated castor oil, 30% phthalic anhydride on solids, non-volatile content=66%.

***6 Gallon Linseed Oil Varnish containing equal parts of Coumarone-Indene resin (M.P. 127-137°C.) and an alkyl-phenolic resin. Non-volatile=56%.

Protective Coatings Corp. Operating in Oregon

The Protective Coatings Corporation, of Oregon, is now in operation at its location, 3419 S. W. Moody Avenue, Portland, Oregon. This plant will operate under the same policies as the Protective Coatings Corporation, of Richmond, California. While each organization is a separate corporation, they will act as one unified service to the trade.

wax emulsions

By ANTHONY FIGLIOLINO

AN emulsion is a homogeneous suspension of oil in water or water in oil. An example of the oil in water type is the rubless, self-polishing floor wax, and the water in oil is represented by butter. The term "oil" in the above does not necessarily limit emulsions to oils alone. "Oil" as used here may signify anything that does not mix with water; and for the purpose of this article it means "wax".

Rubless floor polishes are usually emulsions of wax or waxes dispersed in water, the result being a water like or slightly heavier than water product. The emulsions range from a light clear solution on one side to one that is almost opaque. The most generally used wax is carnauba, although other waxes can be incorporated into the formulation. Usually in industry, carnauba wax is blended with other waxes such as candelilla and montan waxes just to mention a few. The purpose of this substitution is to lower the cost of the finished polish. When other waxes are used to replace either all or part of the carnauba wax the lustre and hardness of the film are almost invariably impaired. When formulated properly however, the inclusion of a wax such as candelilla will result in a film having increased non-slip properties. Resins also impart this property to a great extent.

Properties Desired

SOME of the important properties of a polish which must be observed in order to obtain a satisfactory wax film are as follows:

Leveling—A polish in order to be satisfactorily applied and be pleasing to the consumer, must flow out evenly over the floor surface so as to give a uniform appearance. A streaky uneven application will leave a taste of untidiness.

Water Resistance—A very important property indeed, for a film having poor water resistance will have tendency to re-emulsify in the presence of water and will become spotty. Another disadvantage of a film that is softened when it comes in contact with water is the danger of slipping it presents to people walking on such a film.

Hardness—A film that is soft will smudge easily and produce too many scuff marks. The finish must be hard enough to prevent this. Some manufacturers attempt to obtain this balance by using too much resin in their formulations. Resins will give them the hardness, but at the same time, due to a deficiency of wax, the product will result in a film that is lacking in self-healing properties.

Gloss—Aside from protection that a good floor wax formulation should provide, one of its important properties is its ability to polish without rubbing. This is the basis of the self-polishing, non-rubbing floor waxes. This phenomenon is obtained by a proper combination of wax or waxes and emulsifying agents, in conjunction with equipment for handling the manufacturing of the polish.

Formulation

ON the whole, methods for formulating have been attained mostly by trial and error. The reason for this is due to the eccentricities involved in polish making. Empirical formulae are necessary because each new emulsion represents a problem having many factors. All waxes or combination of waxes must be treated differently depending on their ease or difficulty of emulsification. Waxes exert variable surface tension on the finished product, depending on the chemical constituents contained in the wax, therefore necessitating a change in the amounts or type of emulsifying agents used when a wax combination is altered.

Before modification of a formula is attempted, the manufacturer should first master the technique of preparing his particular formula. One of the major factors in the preparation of a new formula is the wax-water ratio. Up to a certain point an increase of water will result in a lowered viscosity of the polish, and in some instances a decrease in the amount of water will either result in an inversion of the phase from oil in water to one of water in oil; and a change from a liquid emulsion to one that may be pasty or semi-solid. If properly formulated, a wax emulsion may be stored at a high concentration of solids without endangering its stability. In this manner a manufacturer may store in his tanks a larger quantity of wax than he ordinarily could. The concentrated emulsion is diluted to the proper solids when ready for shipment.

The quantity of emulsifier incorporated into the product is dependent on many factors, such as, viscosity, type, color, stability, cost, etc. It is usual to start out with an amount equal to that contained in a competitive product and then vary, depending on the desired results. To insure a stable product, it is best to make up a number of batches, varying the components slightly and allowing them to age. In order to weed out the very poor emulsions, an aging period of seven days at a temperature of 140 degrees F will suffice. Another set of samples should age at atmospheric temperature so as to simulate actual storage conditions. The melting point of the wax mixture should not be over 100 degrees C; if it is above this temperature, it should be first melted with either another wax or other components of the emulsion so that the combined melting point

PHYSICAL AND CHEMICAL PROPERTIES OF WAXES

WAX	SPECIFIC GRAVITY	MELTING PT. °F.	REF. INDEX	DIRECT ACID NO.	SAP. NO.	UNSAPON. %	IODINE VALUE	ACETYL VALUE
Beeswax	0.957–0.976	144–158	1.4397–1.4451 @ 75° C	16.7–20.5	85–95	52–57	5–11.5	15.3
Candelilla	0.971–0.995	148–158	1.4555 @ 71.5° C	17–19	46–66	70	14.5–36.5	.....
Carnauba	0.991–0.999	183–196	1.45 @ 60° C	4–9	78–88	55	14	56
Montan	1.0 crude	170–198	.....	15–20	76–88	35	10–15	.....
Ouricury	0.849–0.864	158–162	1.4539–1.4579 @ 40° C	.....	186–194	.....	35–41	.....

Table I

is below 100 degrees C. For example, a phenolic resin is melted with carnauba or with a fatty acid if they are constituents of the emulsion. There is no universal emulsifying agent for floor polishes, one which will give a perfect emulsion in one case, may be useless in another. The same thing is true of methods employed for manufacturing floor polishes.

The difference in the water resistance of polish films may be perceived quite readily by applying them to a dull black linoleum. After the wax film has been allowed to dry for forty-eight hours, place a drop of water on the film and let it stand until all the water has evaporated. A film containing morpholine will repel the water and leave no spot on drying. A triethanolamine potash film will soften but it also will not spot when dried. A triethanolamine borax film will soften and cloud upon immediate contact with water and will leave a white spot on drying. All of the above statements are true if the wax emulsions are correctly formulated. It must be borne in mind that perfect results cannot be obtained until a few experimental emulsions are made in order to become familiar with working conditions. Variations in raw materials, procedures, errors in proportions, invariably will produce poor results. When changes in the formula are being considered, it is wise to vary one ingredient at a time. This enables one to know exactly what produces the change in the finished product. The temperature of the ingredients used cannot be overstressed. Good emulsions are only obtained when the temperature of the water and wax are as close as possible to 100 degrees C, never under 95 degrees C.

Types

SOME floor polish formulations exemplifying the above principles will be found in the following:

Triethanolamine-Borax-Emulsion

Carnauba wax (#1 or #2)	50.0 lbs.
Oleic acid	5.9 lbs.
Triethanolamine	8.5 lbs.
Borax	4.0 lbs.
Boiling water	500.0 lbs.

For maximum efficiency, a steam jacketed kettle having a slow speed mixer is preferred in order to prevent overheating and caking of the wax on the sides of the kettle.

The carnauba wax, oleic acid and triethanolamine are added to the kettle and allowed to melt. In the meantime dissolve the borax in 20–25 lbs. of boiling water. Add the solution to the molten wax mixture (maintained at 95 degrees C minimum) slowly while agitating until a clear, viscous and homogeneous mass is obtained. With slow steady stirring, add the remaining water slowly; after each addition of water be sure that the wax mixture is thoroughly mixed to a clear mass. Repeat this procedure until all the water has been added. When approximately ½ of the water has been added, it will be noted that the wax mixture has become quite clear and viscous, resembling petrolatum in physical properties. At this point the mixture begins to thin out with each extra portion of water. The remaining water can now be added at a steady pace without affecting the resulting emulsion. Some manufacturers add only 2/3 of their water as boiling and the remaining 1/3 as cold water. Care should be exercised at this point that the water is not added too rapidly. The reason for the above modification is to cool the emulsion quickly and thus prevent or decrease the possibility of crusting or graining at the surface. One theory is that it also prevents the coagulation of the finely dispersed wax particles by lowering the temperature of the emulsion below the melting point of the carnauba wax or wax combination.

Triethanolamine-Potash-Emulsion

Carnauba wax (#1 or #2	50.0 lbs.
Oleic acid	5.2 lbs.
Triethanolamine	10.4 lbs.
Potassium Hydroxide (85% KOH)	0.6 lbs.
Boiling water	382.0 lbs.

The same equipment and precautions are used in this formulation as in the previous one. The carnauba wax, oleic acid and triethanolamine are melted and kept at a minimum of 95 degrees C. Dissolve the potassium hydroxide in 2–3 lbs. of boiling water and add while stirring to the melted wax. When clear, add the water slowly, allowing the wax mixture to become clear and viscous. As in the previous formulation 2/3 of the water may be added as boiling water, and 1/3 as cold water. If increased water resistance is desired approaching that of morpholine, 15–20 lbs. of ammonia (28 degrees Baumé) may be substituted for the potassium hydroxide. In the two formulae described above the triethanolamine may be added after the wax

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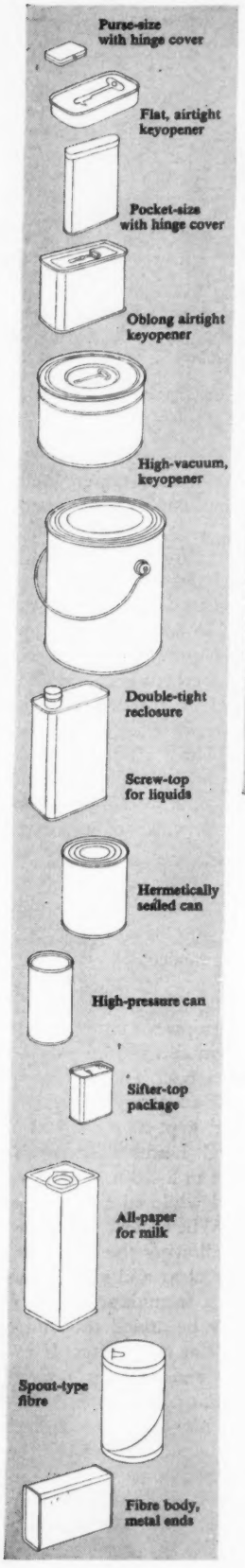
WHICH PACKAGE SUITS YOUR PRODUCT?



This familiar oblong container comes with either a screw-top or u-press-it fitting. Also available in a variety of sizes with pouring spout, seal closure *and many other types of fittings for consumer convenience.*

Are you considering the consumer when you package liquids?

This container makes friends—keeps 'em!

You know it as the handy can that pours easy, doesn't drip and closes tight.

Advertising experts and sales managers know it as the package that "works with" the label—plenty of space to show your brand in brilliant color.

It now helps sell such products as linseed oil, turpentine, paint and varnish remover.

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To sum up, *this container is ideal for many liquids where positive reclosure is essential.*

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and oleic acid mixture has been melted and mixed well. Some manufacturers claim a finer dispersion of the wax in this manner.

Morpholine Emulsion

Carnauba wax (#1 or #2	50.0 lbs.
Oleic acid	10.2 lbs.
Morpholine	6.3 lbs.
Boiling water	500.0 lbs.

The carnauba wax and oleic acid are melted and maintained at a temperature of 95 degrees C. Stir well and then add to morpholine. When the mass has become clear add approximately 25 lbs. of boiling water. Stir until a clear mixture is obtained and then add the remaining water with constant agitation. As in all of the previous formulations, the mixture becomes increasingly viscous and then suddenly thins out. If preferred, 2/3 of the water may be added as boiling and 1/3 as cold water.

Of considerable importance in the past few years is the tremendous inroad in the polish trade that oxidized petroleum waxes have made. Pure petroleum waxes are not adaptable for use in self-polishing floor wax emulsions in their natural state due to the difficulty encountered when attempting to saponify them. By oxidizing the wax the acid number and saponification value are increased to such an extent as to render them emulsifiable. A number of our better known wax manufacturers are now using carloads of oxidized wax, and the quantity is increasing. The most attractive feature of this type of wax is its low cost as compared to carnauba wax. In floor polishes, it approaches the lustre of carnauba. It is resistant to wear, and furthermore it enhances the non-slip qualities of the film. Below is a typical formula incorporating an oxidized wax.

Oxidized Type

Carnauba wax (#3)	44.3 lbs.
Oxidized wax	22.3 lbs.
Sodium Oleate	10.5 lbs.
Triethanolamine	2.3 lbs.
Borax	3.2 lbs.
Boiling water	520.0 lbs.

Melt waxes. When melted add the soap flakes and stir well until the sodium oleate is well dispersed. Keep temperature around 95 degrees C. Add the borax which has been dissolved in an equal quantity of water. Stir well while still keeping a temperature of approximately 95 degrees C. The triethanolamine is now added and stirring is continued until the wax mixture is well incorporated. Add the boiling water in small quantities while agitating. Each addition of water should be added and stirred until the mass assumes a vaseline-like consistency. When about ½ of the water has been added the consistency will thin out. At this stage the water can be added rapidly. If desired, some cold water may be substituted for the boiling water.

Additives

THE spreading and flow out properties of non-rubbing floor polishes are increased by the addition of resin dispersions or solutions. Some of the more commonly known resins are blonde bleached dewaxed shellac and manila loba B. The former produces excellent results when used in conjunction with triethanolamine, whereas manila gum is better adapted for use with morpholine floor polishes. Casein dispersions can be used with any type polish and enhances the smoothness of the film more than either the shellac or manilla. The one drawback to the use of casein is the poor water resistance it imparts to an emulsion containing it. For this reason it is usually never incorporated in any formulation. Resin. formulations using the above are as follows.

Manila Dispersion

Manila Loba B (powdered)	105 lbs.
Ammonia (28 degrees Baumé)	45 lbs.
Water	735 lbs.

The ammonia and manila powder are mixed well followed by the addition of about 15 lbs. of water (heated to approximately 60–70 degrees C). The above is stirred well until a gummy mass is produced. This is allowed to stand anywhere from 10 hours to overnight. Add another 15 lbs. of warm water, always stirring. When a homogeneous mixture is obtained, heat the entire batch to 65 degrees C and stir in the remaining water. If the dispersion is not clear add more ammonia until a clear solution results. Any undissolved particles are removed by filtering. The filtered dispersion is allowed to cool and is now ready for use. Usually 20% by volume is added to the floor polishes to produce a suitable product.

Casein Dispersion

Casein (lactic acid)	105 lbs.
Ammonia (28 degrees Baumé)	99 lbs.
Phenol	5 lbs.
Water	672 lbs.

Soak the casein in ½ of the water overnight, add the ammonia to the remaining water. Stir this solution into the casein, water mixture. Heat the above to 75 degrees C while agitating until a smooth and homogeneous mass is obtained. In order to have an anti-putrifying agent or preservative, the phenol is added. For consistent results it is usually wise to allow the casein dispersion to stand a week to 10 days to allow the mixture to attain its true viscosity.

Shellac Dispersion

Shellac (bleached, dewaxed)	105 lbs.
Ammonia (28 degrees Baume)	15 lbs.
Water	735 lbs.

Add ammonia to the water; while agitating add the shellac. Heat to 160–170 degrees F and maintain at this temperature until solution is complete. If the solution is not clear add sufficient ammonia to make it so. Filter, cool, and add to the cold floor wax emulsion. Approximately the same percentage by volume is used for the above as was employed for the manila gum dispersion.

Numerous waxes are employed in conjunction with carnauba wax when preparing a floor polish. A description of some of the most commonly used waxes appears below so as to assist and familiarize the reader with their properties.

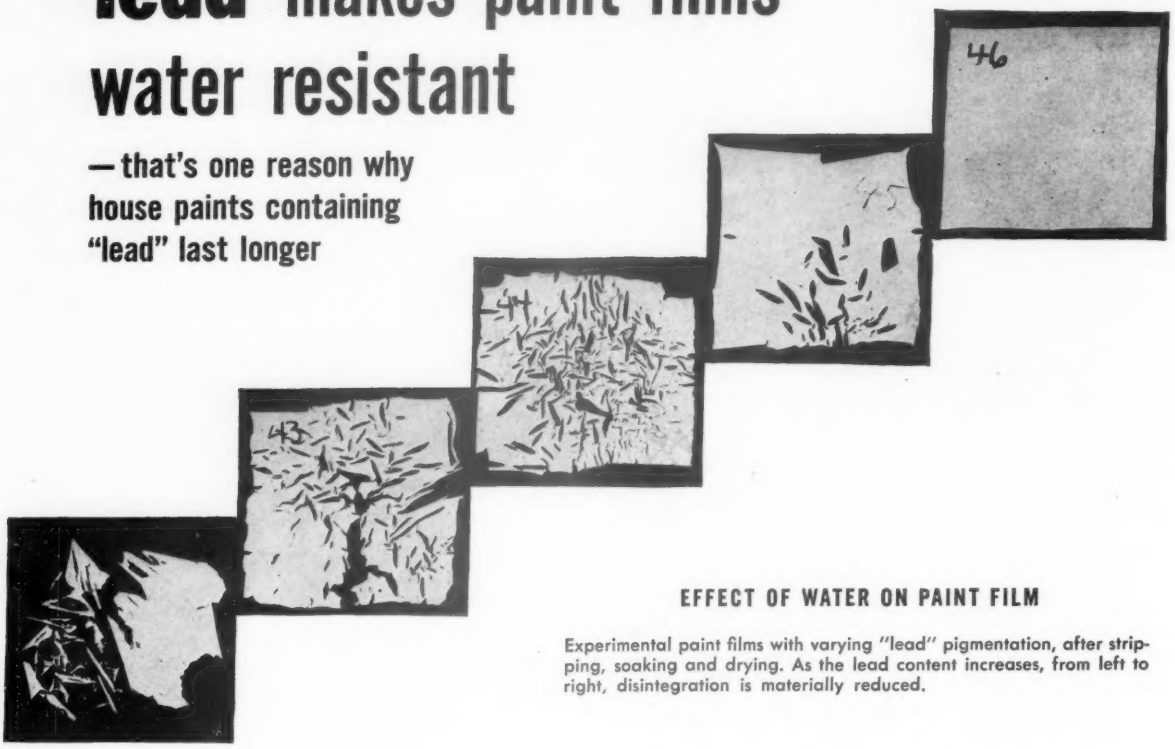
Candelilla Wax

This wax is of vegetable origin and is found in nature as a coating on the surface of the plant Euphorbia Antisphilitica. The plants are located in northern Mexico and southern Texas. The wax is separated from the leaves of the plant by immersing them in boiling water. The wax melts and rises to the surface. The crude product thus obtained is dark brown in color. Another method of extraction incorporates the use of a boiling 2% sulfuric acid solution. When purified the wax is opaque and of a brownish yellow color. It is hard, lustrous and brittle. Candelilla wax is not as hard as carnauba wax and its emulsification is not accomplished as readily.

(Turn to page 31)

"lead" makes paint films water resistant

—that's one reason why house paints containing "lead" last longer



EFFECT OF WATER ON PAINT FILM

Experimental paint films with varying "lead" pigmentation, after stripping, soaking and drying. As the lead content increases, from left to right, disintegration is materially reduced.

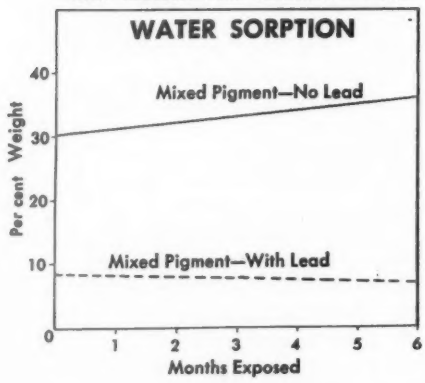
Water is probably the worst enemy of any paint film. It tends to decompose and dissolve away portions of the film. It also tends to emulsify the film causing it to swell and blister. It is generally considered the greatest single cause of loss of adhesion.

The inclusion of white lead pigments in formulations for house paints is the surest means of mastering these conditions. Paints containing "lead" are highly resistant to water—absorb only a small percentage of what they would otherwise. On films of lead-pigmented paints, water appears as distinct droplets—does not penetrate—whereas paint films lacking this ingredient are completely wetted.

This high repellency to water—resistance to pick-up of water within the film—is another reason for using "lead" in your paints. And use enough of it to take full advantage of the many desirable qualities that white lead pigments impart—qualities which mean better paints, greater consumer satisfaction and larger sales.

For detailed information on the most effective use of "lead" in your paints . . . write to *Lead Industries Association, 420 Lexington Avenue, New York 17, N. Y.*

"Lead" Increases Water Resistance of Paints



Water sorption graph shows how lead decreases the water pick-up of mixed pigment paints.

"LEAD" LENGTHENS THE LIFE OF PAINT BECAUSE:

It Stabilizes — neutralizes acidic compounds resulting from the decomposition of the vehicle — prevents the film from becoming soft or liquefying.

It Plasticizes — forms lead soaps which increase film flexibility.

It Strengthens — flexible, spiney crystals in lead soaps mechanically reinforce the film and increase elastic strength.

It Resists Water — paint films with an optimum lead pigment content absorb only a small fraction as much water as they otherwise would.

6685

Strength of Surface Coating Films

By HENRY GRINSFELDER,
Research Laboratories
Rohm & Haas Co.

YOU know people have told me lately that paints are not good. They say that the coating is usually the first portion of a manufactured article to show signs of failure. In defense of the coatings technologist I bring to their attention that he is transforming material at the rate of one billion dollars a year from a stable, free-flowing, liquid to a tough, attractive, protective film in the space of a few minutes or hours and, in so doing, is performing one of the amazements of science. Also, I know how difficult it is for the chemist to achieve the properties and all the properties desired in an enamel without compromise. It usually is impossible, and at the present state of development of coatings technology, unreasonable, to expect.

However, rather than rest contentedly on his laurels, paint chemists all over are continuing their search for new and better ways of making organic coatings. A part of this search and study has been conducted for the past several years at the research laboratories of the Rohm & Haas Company. It was hoped that out of this work would come information which would lead to a better understanding of film formation, film behavior and film breakdown. If such information was obtained, then it was reasoned that the organic chemists might be in a better position to synthesize improved vehicles. Perhaps, too, this increase in our knowledge of film behavior would enable us to make wiser recommendations regarding vehicles for your specific problems.

This paper was presented before the November 1950 meeting of the New York Paint and Varnish Production Club for publication in the Official Digest and is published here with their permission.

Film Performance

BEFORE undertaking the actual laboratory studies, we tried to obtain a picture of the factors at work that determine film performance. In our simple analysis, coatings were imagined to be thin plastics adhered to a substrate. These plastics are cast from solvent solutions, and are formed by solvent evaporation, oxidation, polymerization or combination of two or all three of these mechanisms. As the solutions are cast, they wet the substrate and adhere to it by capillarity, interfacial tension, van der Waal's forces or some of each. As the film forming process operates, a shrinkage in volume occurs. Just how much of this shrinkage is uniform is not known. It is conceivable that it may be very non-uniform, but there is a good possibility that some appreciable shrinkage occurs in each of the three dimensions of a paint film. As the film dries and forms, cohesive forces develop and the coating gains strength.

The shrinkage along the tangential dimensions of the substrate will then be a force acting to destroy the adhesive forces. Immediately, then, upon formation of a film there are set in action opposing forces which are not conducive to the best in film performance. In other words, there are two major forces existing in a coating film. One of these forces is of an adhesive type, the other cohesive. Maintenance of those forces at a high level and in the proper balance produces a film of high integrity. Loss or change of either or both of those strength factors results in stresses appearing in the film aiding degradation and which may eventually lead to failure. If the adhesive strength is reduced, the failure appears in the form of blistering or peeling. If the cohesive strength is lost, failure is noted by chalking. If cohesion increases while adhesion decreases, such types of failure as pinholing or alligatoring may result.

Film Degradation

OFTEN films that start out with high integrity change for the worse during their life. This degradation may be caused by any one of a

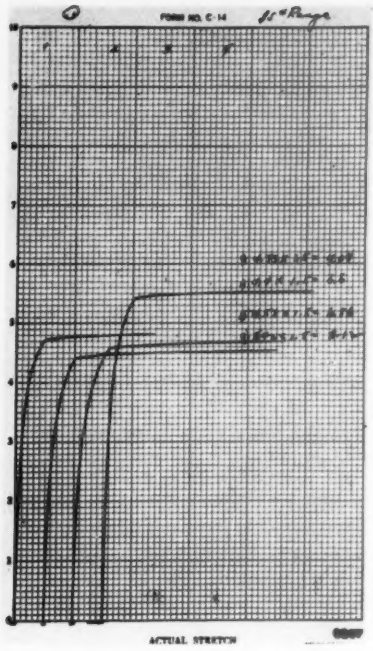


Fig. 1. Typical stress-strain diagram.

wide variety of conditions. Some are seemingly so mild as to be harmless. Others have long been recognized as being severe. Considered to be severe are such factors as sunlight, heat, oxygen. Not usually thought of as deleterious are the slight changes in moisture content and temperature of the air from day to night or from day to day. As the relative humidity of the air varies, a change in the moisture content of a coating occurs. Increase in moisture content increases the volume of the coating so that it swells or tries to, depending on the magnitude of the adhesive force. Similarly, the cohesive strength and the adhesive strength of the film are diminished as the moisture content of the film increases. A lowering of the moisture content of a film has the opposite effect. Exposure to cycles of high and low humidity may lead to a fatigue of the film's strength—just as constant flexing of a copper wire will cause a fatigue failure. Temperature changes in the air surrounding a film may create the same type of action and lead to failure. To complicate the mechanism even further, films are often exposed to sudden lowering of the temperature below the dew point. Then the moisture vapor present in the film changes state and becomes a liquid. A localized expansion occurs upon this change in state and a cleavage not unlike that caused by water freezing to ice to crack a stone or a cement sidewalk appears.

Other possible factors aiding film degradation are those of under the film corrosion, oxidation, and auto catalysis.

In retrospect then, it can be reasoned that organic coatings are unstable from the moment they are first applied to the day they finally disappear by chemical degradation as carbon dioxide and water vapor.

Preparation of Free Films

WITH that preliminary concept of the mechanism of film formation and coating behavior, it appeared to us that a good place to begin a study of a fundamental nature would be to determine the strength properties of organic coatings both initially and under various types of exposure conditions. The research program actually had its start about 1942 when a basic study of plasticizers for cellulose nitrate lacquers was undertaken. The method adopted and used successfully at that time for determining the merit of the material was to test a free film of the lacquer. The free film was easily prepared by first applying the lacquer to a plate glass panel, drying the film and exposing the coated plate to a blast of low-pressure steam. The lacquer could then be easily stripped off as a free film and examined in its unsupported state. Our interest in coating vehicles is rather wide, covering in addition to cellulose nitrate lacquers such materials as alkyd resins, varnishes, baked urea/alkyd or melamine/alkyd combinations, acrylic resins and vinyls. However, none of these other vehicles responded as nicely as cellulose nitrate to the steam removal technique. Fortunately for us, the National Lead Co. had developed in their laboratories a method for free filming house paints and *Oscar Muller* and *E. J. Dunn, Jr.*, of that organization very kindly taught us their techniques, when we told them of our interest. In their method, films are coated on tin plated steel panels (Figure 1). When ready to remove, all that is necessary is to place the panel, coating side up, on a bath of mercury. The tin is amalgamated on contact with mercury, assumes the liquid state and permits the coating to separate and float to the top of the bath as a film.

Free films can readily be measured for tensile strength and elongation during test using a Scott Inclined Plane Test Machine (Figure 2 and Figure 3).

The free films obtained in the above manner can also be used for determination of moisture-vapor transmissivity, shrinkage upon removal, equilibrium moisture content and other properties.

However, determination of adhesion is another and more difficult matter. We have worked cooperatively with both the Adhereometer of Interchemical Corp. and the Mar Adhesion Tester of the Bell Telephone Laboratories. Each of these

Fig. 2. Film in the process of being cast.

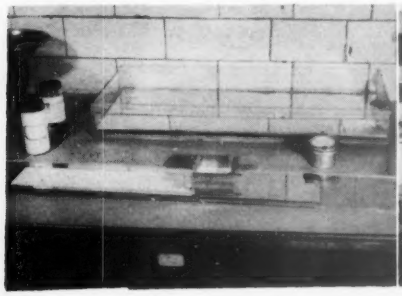


Fig. 3. Scott IP-4 Tester at start of test.

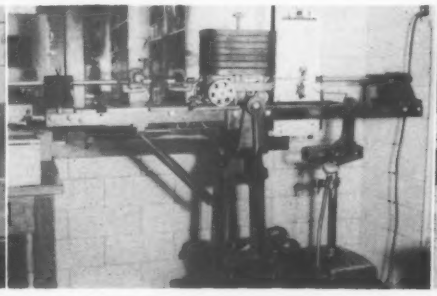
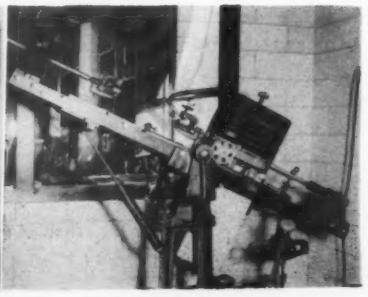


Fig. 4. View of Tester at completion of test.



instruments has given us data leading to a clearer insight into film behavior but I am not sure that either measures the true adhesive strength of paint films to the substrate. I am therefore reluctant to discuss the data so far obtained and will omit that from my presentation.

In further detail, the method of preparing a free film starts by applying an enamel to a steel panel specially plated with hot dipped tin. In our work, the panels used were .025″ thick, being this thick to insure flatness and were purchased from Gustav Schmidt, 109 Bridge Street, Brooklyn, N. Y. To produce films of exactly the desired thickness, an adjustable gap filmograph is used. (See Figure 1) From experience, we have learned that for enamels having a #4 Ford Cup viscosity in the range of 70 to 85 seconds, a wet film will be laid down that is only one half as thick as would be expected from the width of the gap opening. Knowing the solids content of the enamels at the time of application, it is a simple matter to calculate the correct gap opening to obtain any desired dry film thickness. The filmograph is adjusted accordingly, filled with the enamel and dragged at a uniform rate along the tin plated panels by using a constant speed motor drive.

Tensile and Elongation

FOR determining the tensile strength and elongation of the films in the Scott IP-4 tester, specimens 4 inches long and one half inch wide are used. The jaws of the test machine are two inches apart at the start of the test. To protect the films from the cutting action of the grips, Scotch Tape is placed on the film. The Scotch Tape reinforces the film and insures breakage at a point away from the jaws. Usually four or five specimens are replicates. Typical results are shown in Figure 4. In our work, the tensile strength is calculated to the basis of the film cross sectional area at the time of break by use of the following formula:

$$\text{Tensile strength} = \frac{\text{Ultimate Load } (\% \text{ ultimate elongation} + 100)}{\text{Film Thickness} \times .5 \times 100}$$

$$\% \text{ Ultimate Elongation} = \frac{\text{Inches Elongation} \times 100}{2 \text{ inches}}$$

TABLE ONE

Plasticised N/C Films

	Dibutyl Phthalate	Sebacic Acid Alkyd	Blown Castor Oil	Raw Castor Oil
Initial Toughness	105	243.7	116	120
Decrease due to				
a) Water Immersion	70%	46%	(gain) 25%	33%
b) Heat	14%	5%	(gain) 15%	16%
c) Ultra Violet	95%	49%	94%	81%

a) 150°F. for 24 hrs., b) 150°F. for 120 hrs., c) 32 hrs. Fadeometer

TABLE TWO

Comparison of Vinyl Copolymer and Cellulose Nitrate

	Vinyl	Cellulose Nitrate
Initial Toughness	5695	243.7
Loss of Toughness on Fadeometer Exposure		
(100 hrs.)	36%	—
(32 hrs.)	—	49%
Weatherometer (1000 hrs.)	27%	

TABLE THREE

Description of Alkyd Resins

Alkyd No.	Phthalic Content (%)	% Oil	Type of Oil	Type of Polyhydric Alcohol	Viscosity as supplied	A. No.	Solvent	Solids
1	42	37	Cottonseed	Glycerine	Z7	5-10	Xylol	60
2	39	42	Soya	Pentaerythritol	Z6	3-9	Xylol	62
3	33	53	Linseed	Glycerine	Z6	5-15	Mineral Thinner	60
4	33	54	Soya/Castor	Glycerine	Z6	0-8	"	60
5	32	51	Castor	Pentaerythritol	Z2	0-8	"	50
6	24	65	Soya	Pentaerythritol	Z3	6-8	"	70
7	Present		Soya	Pentaerythritol	X	4-7	"	50
8	29		Castor	Glycerin	Z6	20-40	Xylol	70

TABLE THREE A

General Classification of Alkyd Resins

Alkyd No.	
1	Baking type - Metal Decorating & White Baking Finishes
2	Baking type - Fast Bake white & colored enamels
3	Exterior, air dry coating
4	General purpose, air dry or bake
5	Automotive refinishing
6	Architectural
7	Architectural modifier
8	Primer and surfacer for wood & metal

TABLE FOUR

Initial Film Properties by Free Film Method

Alkyd	Moisture Vapor (a) Transmissivity (24 hrs.)	Tensile (b) Strength (psi)	Ultimate Elongation
1	$.545 \times 10^{-8}$	2522	99.5
2	$.490 \times 10^{-8}$	2967	67.8
3	$.469 \times 10^{-8}$	3155	59.0
4	$.625 \times 10^{-8}$	3168	80.0
5	$.530 \times 10^{-8}$	3393	66.0
6	$.656 \times 10^{-8}$	3050	51.0
7	1.025×10^{-8}	2483	33.5
8	$.288 \times 10^{-8}$	3278	39.5

(a) The number of grams of water vapor calculated to represent diffusion through one centimeter of a cross sectional area of one square centimeter in one hour at 1 mm. difference in pressure of moisture vapor.

(b) Corrected for the cross sectional area at the time of break.

TABLE FIVE

Eight Weeks' Aging Study

Alkyd No.	Tensile Strength (psi)		Ultimate Elongation (%)	
	A	B	A	B
1	2323	2236	56	52
2	4381	4603	35	40
3	4217	4859	49	30
4	3558	3901	56	58
5	4516	4561	51	53
6	3576	3900	35	38
7	3060	3672	19	24
8	Too brittle	Too brittle	Too brittle	Too brittle

A - Aged on panel, then removed as a free film

B - Removed at start, then aged as a free film

TABLE SIX

Pigmented Alkyd Films

Alkyd	Initial Toughness	Loss Due to Accelerated Exposure Conditions		
		Heat (a)	Ultraviolet (b)	Weatherometer (c)
1	1250	34%	97%	91%
2	1005	27%	100%	91%
3	930	37%	98%	90%
4	1265	Gain 8%	94%	70%
5	1120	22%	99%	79%
6	777	6%	85%	6%
7	419	42%	100%	70%
8	650	100%	100%	100%

a- 140°F. for 100 hrs., b- 100 hrs. Fadeometer, c- 120 hrs.

Film thickness is obtained by measuring them with an Ames Gauge.

The energy required to rupture a test specimen is generally considered to be a measure of its toughness. An approximation of the energy requirements is obtained by measuring the area under a stress-strain curve. Inasmuch as most of the stress-strain curves were of the same shape, and to simplify the presentation, toughness factor has been assumed to be the area of a triangle having % elongation as its base and ultimate tensile strength as its altitude.

Table I illustrates the general type of results obtained in the original studies of plasticizers for cellulose nitrate. Each of the plasticizers was incorporated into the cellulosic at a concentration of 35%. You will note that the sebacic acid alkyd produces a considerably higher initial toughness than do the other materials. The superior resistance of the sebacic acid alkyd to Fadeometer exposure is also readily apparent. Recently, cellulose nitrate has been replaced rather widely for use in the field of coated fabrics by vinyl chloride. Table II shows a comparison of the best of the results in Table I to a conventional vinyl chloride film plasticized with dioctyl phthalate.

Not only is the vinyl film more than 20 times tougher but it also is able to resist the rigors of 100 hrs. Fadeometer exposure better than the cellulose nitrate film does 32 hrs. It is easy to understand why the tremendous interest has developed in the use of vinyl resins. However, the magnitude of the toughness of vinyl points up its major deficiency as a coating —that of low adhesion.

Alkyd Study

FOR orientation purposes, it was next decided to examine eight conventional, commercially available oxidizing oil-modified alkyds. Since these alkyds had received full-scale use and acceptance, their properties could serve as a criterion for future reference. The alkyds ranged from high to low phthalic content, included both glycerine and pentaerythritol types as well as maleic modifications. A summary of their chemical composition and physical constants is shown in Tables III and IIIA.

It will be noted from examining the data in Table III that the alkyd

resins do not conform to a homologous series of any type, size, shape or description. They are conventional alkyds of practical worth, proven over the years for their drying, color, gloss, aging, cost and other final end-use properties.

The eight alkyds were each used in a white enamel containing on a solids basis 50% titanium dioxide pigment, type RA and 50% alkyd resin. To each enamel was added cobalt napthenate drier in the amount of .05% cobalt metal on alkyd resin solids. The enamels were reduced to a viscosity in the range of 70 to 85 seconds as measured in a #4 Ford viscosity cup using as a reducing solvent, the same solvent as that in which the alkyd resin is supplied.

Table IV summarizes the initial data obtained on the alkyd films. These values were measured on films air dried 96 hours on the panel, stripped, air dried an additional period of 48 hours before testing.

Moisture Vapor

MOISTURE vapor transmission was determined on free films stretched tautly over a vaporimeter cup containing about 25 grams of anhydrous calcium chloride. The film was clamped tightly with a rubber sealing gasket. The cup was placed in a constant temperature (77°F.), constant humidity (55%) room, weighed at the start and after 24 hours. The method for handling the data was that described in the Bell Labs Record for June 1947. The actual formula used was:

$$D = \frac{NX}{At(P_1 - P_2)}$$

where D is the Diffusion Constant
N = Number of grams of water diffused
X = Film thickness
A = Cross sectional area of film
t = Hours
$P_1 - P_2$ = Difference in pressure of water vapor on the two sides of the film.

Aging

IT WAS noted during this initial phase of the work that the films were noticeably tacky upon removal from the metal panel. This finding was a completely surprising one and

TABLE SEVEN

Clear Acrylic Films (Baked)

Acrylics	%Elongation	Ult. Tensile	Toughness
MMA	19.2	3620	347
EMA	18.0	2790	252
BuMA	49.0	2540	621
Iso Bu Ma	8.0	1070	42.3

TABLE EIGHT

Toughness Factor

	Oxidizing Alkyd 95/5 TiO_2 /ZnO	Non Oxidizing Alkyd TiO_2
Fast Curing Urea Resin	105	40
Highly Compatible Urea Resin	261	165
Melamine Resin	273	—
Water Resistant Grade Urea	217	40

TABLE NINE

Blister Rating Compared to Film Hardness

Bake Schedule - 15 min. at 300°F.

	Oxidizing Alkyd		Non Oxidizing Alkyd	
	TiO_2	5% ZnO	TiO_2	5% ZnO
Pencil Hardness	F	B	H	F
Blister Rating	Very large	Small	Small to medium	Minute to tiny

TABLE TEN

Alkyd Concentration Effect

(Baked 15 min. at 300°F.)

Alkyd	Oxidizing 100% TiO_2	Oxidizing 5% ZnO_2 95% TiO_2	Non-Oxidizing 100% TiO_2	Non-Oxidizing 5% ZnO_2 95% TiO_2
60%	(F) Very large	(B) Small blisters	(H) Small to medium blisters	(F) Minute & tiny blisters
70%	(H) Very large	(B) Minute & tiny blisters	(F) Medium blisters	(B) Minute blisters
75%	(HB) Medium blisters	(B) Trace of minute blisters		

TABLE ELEVEN

Effect of Pigment Concentration

	100% TiO_2	5% ZnO_2 95% TiO_2
45% Pigment	(F) Medium & large blisters	(B) Tiny & small blisters
52.5% Pigment	(H) Very large blisters	(B) Minute & tiny blisters

gave us a new insight into the mechanism of drying and adhesion of oxidizing alkyd films. Gradually the "tack" disappeared. To determine if the disappearance of tack represented an appreciable change in film characteristics, a comparison between films aged before removal and after removal was made. The total time before testing was 8 weeks in both instances. The results of this aging study are tabulated in Table V.

It is readily noted upon examining the data that aging the films in their free state for eight weeks produces higher tensile strength, but except for one alkyd no appreciable change in % ultimate elongation. It would appear that exposure to air is causing some rapid changes in film character. This is even more noticeable if one compares the data in Table IV with that in Table V. Particularly striking is the effect on alkyd #8, which at eight weeks' age is too brittle to test. The other films resist this eight weeks' aging in varying degrees. Alkyd #4 seems to show an unusually large effect due to aging as a free film and alkyds #1 and #5 show only a small effect.

More rigorous aging tests were next considered desirable to learn if these trends continued. Accordingly, films were exposed in their initial supported form to Fadeometer, Weather-O-Meter and oven exposure. In general the results presented in Table VI indicate that exposure to 100 Fadeometer hours produces more marked changes in the films of this study than does 120 Weather-O-Meter hours, which in turn is more severe than 100 hrs. placement in an 140°F. oven. It is also evident, that there is no similarity in the relationship among all of the alkyds. For example, alkyd #8 is the stiffest of the alkyds after oven aging, but next to the most flexible after Fadeometer exposure.

In this table, cognizance should be made of the poor resistance to ultra violet light inherent in Alkyds #1, 2 and 8. These films, it must be remembered, were prepared only at room temperature drying conditions. In view of the fact that these three alkyds are generally recommended only for baking applications, the comparison may not be of real significance. Alkyd resins #4, #5, #6 and #7 resist the Weatherometer relatively well. Alkyd #6 has received wide acceptance, not only as an architectural vehicle, but also in the more rigorous field of marine paints. It might be noted that the alkyd films lose strength under ultraviolet light exposure to a greater extent than did the vinyl films. When the data show 100% loss of initial toughness, the films are still continuous but so brittle as to be too fragile to handle and place in the test machine. Based on the results, it appears that exposure for 100 hours to the ultra-violet light of a Fadeometer produces a more marked change in the toughness of these alkyd films than does exposure of 120 hours in a Weatherometer or 100 hrs., at 140°F.

For comparative purposes, the data obtained in a study of methacrylate coating resins may be of interest (Table VII). The data are quite variable and do not correlate well with the normal results from materials so closely related chemically. Probably, the polymerization medium, catalyst or inhibitor used influenced the film strength more than the chemical composition of the monomer. Further studies are being made to understand the anomalous results.

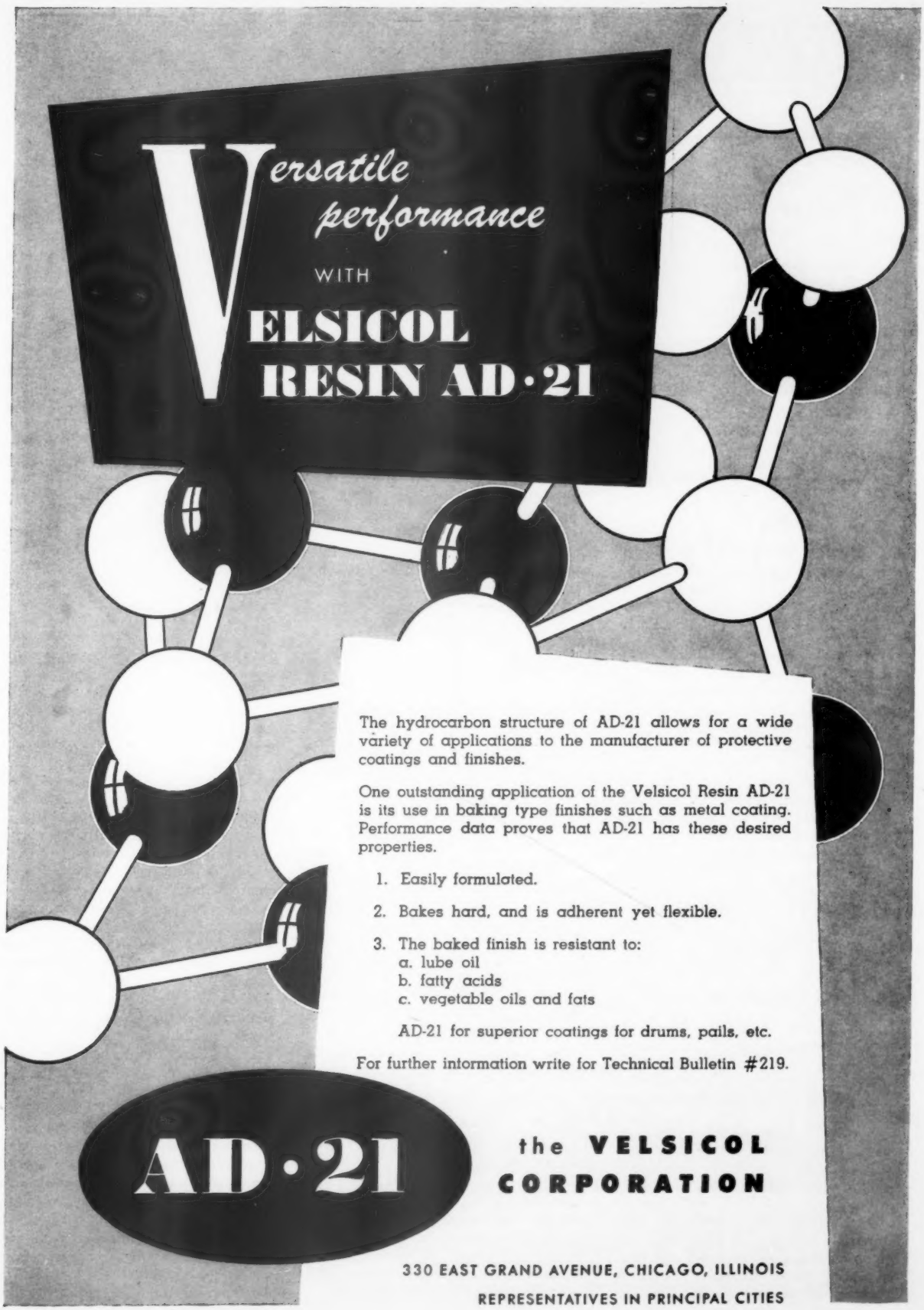
Urea Types

ANOTHER class of coating resins, that of baked urea formaldehyde fortified alkyd resin baking finishes were also examined as free films. Neither these films or the lacquers possessed the tacky undersurface found with the air dry alkyds. The results obtained are presenetd in Table VIII. It is to be noted that the toughness values in this study are low compared to the air-dry alkyds. In the three urea resins, the results seem to be related closely to the curing speed of the resin. The water resistant grade is intermediate between the fast curing resin and the highly compatible one for curing speed and compatibility. Hard to explain on this basis and rather surprising is the film toughness obtained with the melamine resin, which is both faster curing and less compatible than any of the urea resins.

The finding that the faster curing urea resin gave the weaker film and the slower curing resins tougher films prompted us to study the effect of film toughness on water resistance of the films. It could be reasoned that harder films have greater cohesion and shrinkage stresses than do softer films. Due to these shrinkage stresses, adhesion is probably not far from the threshold value of release. When water enters and passes through the film to the interphase, it weakens the already low adhesion beyond the release value. Conversely, a softer, more relaxed film would possess higher initial adhesion values and resist delamination due to water appearing at the interphase for a longer time. A number of factors might aid in producing a softer, more relaxed, higher adherent film. They are such things as shorter baking time, lower baking temperature, inclusion of a small amount of a basic material, such as zinc oxide. There are also methods of altering the enamel composition to improve the adhesive strength. In this category are a) reduced pigment content, and b) reduced urea resin content.

The inclusion of zinc oxide has one other beneficial effect as far as water resistance of a film is concerned. That is its ability to reduce the moisture-vapor transmissivity of the film. Zinc oxide films have a rate of moisture-vapor transmission one fifth as great as does a titanium dioxide pigmented film. Data to illustrate and support this theory explaining the formation of blisters upon exposure to water are presented in Tables IX, X and XI.

The work on the study of film strength is being continued. To date, we have gained an insight into the mechanism of film behavior. We have also learned the magnitude of some of the strength forces available in coating films. It has been amazing to learn how rapidly the strength of coating films change under several, apparently mild simulated service conditions. We are completely surprised at the tackiness of the underside of some air drying, oxidizing type alkyd films, and also surprised at the wide range of film strength from one type to another. At this time, I wish to acknowledge the able efforts of *Emory Slaght* and *Edward Peattie,* who have conducted the experimental work in the laboratories of the Rohm & Haas Co., and to *Dr. Rolle* of the Interchemical Corp. and *C. C. Hipkins* of the Bell Telephone Laboratories for much in the way of cooperation and assistance in this work.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Pigment Binders

U. S. Patent 2,511,113. Fred G. La Piana, Providence, and George N. Houth, Cranston, R. I., assignors to Stein, Hall & Company, Inc., New York, N. Y., a corporation of New York.

A pigment binder containing from about 10% to about 50% by weight of an aqueous dispersion containing from a few to about 60% by weight of a resin selected from the group consisting of vinyl chloride polymers, vinylidene chloride polymers and vinyl-vinlyidene chloride copolymers, said resin being in solid, dispersed form, from about 5% to about 40% by weight of an unvulcanized latex comprising a synthetic rubbery polymer of a butadiene hydrocarbon and containing from about 30 to 70% by weight of solids, and a water-soluble protein-alkylolamine-urea-formaldehyde reaction product in an amount from about 5% to about 25% by weight.

Fungicidal Composition

U. S. Patent 2,510,696. Byron A. Hunter and Norman K. Sundholm, Naugatuck, Conn., assignors to United States Rubber Company, New York, N. Y., a corporation of New Jersey.

A fungicidal composition comprising an aqueous suspension of a 4,5-pyrazoledione-4-oxime, in which the nitrogen in the 1-position is attached to a member of the group consisting of hydrogen and aryl radicals and the carbon in the 3-position is attached to a member of the group consisting of alkyl and aryl radicals, said aqueous suspension containing a dispersing agent.

Alkyl Fumarates

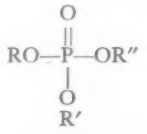
U. S. Patent 2,509,203. Jeffrey H. Bartlett, Westfield, N. J., assignor to Standard Oil Development Company, a corporation of Delaware.

A process of preparing an oil soluble polymer which comprises substantially completely esterifying a molar proportion of a fumaric acid with two molar proportions of C_{12} to C_{14} alkyl alcohol in the presence of a small amount of acidic catalyst, accompanied by heating to refluxing temperature, and thereafter polymerizing, said polymerization being carried out at a temperature of about 50° to 150° C. in the presence of 0.1 to 5.0% of a peroxide catalyst.

Polyvinyl Compositions

U. S. Patent 2,504,120. Harry R. Gamrath, St. Louis, Mo., assignor to Monsanto Chemical Company, St. Louis, Mo., a corporation of Delaware.

A composition of matter comprising a polyvinyl chloride resin selected from the group consisting of polyvinyl chloride and copolymers containing predominantly combined vinyl chloride and containing 20 to 60% of a monalkyl dairyl phosphate ester of the type.



wherein R is selected from the group consisting of an alkyl radical containing at least 6 and not more than 12 carbon atoms and on alkoxyethyl group wherein the alkyl substituent has at least 4 and not more than 12 carbon atoms, R′ is the phenyl radical and R″ is a cresyl radical.

Acylated Derivatives

U. S. Patent 2,500,082. Eugene Lieber, New York, N. Y., and William H. Smyers, Westfield, N. J., assignors to Standard Oil Development Co., a corporation of Delaware.

The process which comprises reacting a substantially linear styrene-isobutylene copolymer having an average molecular weight of 3,000 to 30,000 and a styrene content of 20–60% by weight with stearyl chloride in the presence of aluminum chloride as catalyst and in the presence of an inert non-aqueous solvent, hydrolyzing and removing residual catalyst and subjecting the reaction products to distillation under reduced pressure to obtain the desired stearyl styrene-isobutylene copolymer as distillation residue.

Polyvinyl Acetate Emulsion

U. S. Patent 2,508,343. Wilfred K. Wilson, Springfield, Mass., assignor to Shawinigan Resins Corporation, Springfield, Mass., a corporation of Massachusetts.

A process for preparing a stable aqueous emulsion of polyvinyl acetate which comprises polymerizing vinyl acetate while dispersed in an aqueous medium containing for every 100 parts of water, 1–10 parts of gum arabic, 0.01–2.0 parts of a non-polymerizable surface tension depressant characterized by containing an alkali metal sulfonate group and 10–20 carbon atoms and a sufficient amount of water soluble per compound to supply 0.001–0.1 part of available oxygen, the vinyl acetate being introduced at such a rate that not over about 25 parts of monomer for every 100 parts of water are present substantially throughout the polymerization, the weight ratio of water to total vinyl acetate introduced and polymerized is between 100: 30 and 100: 60, whereby the polymer particles have a diameter of 0.05–0.2 micron.

Acrylonitrile-isobutylene

U. S. Patent 2,504,054. Pliny O. Tawney, Passaic, New Jersey assignor to United States Rubber Company, New York, N. Y. a corporation of New Jersey.

A new composition of matter comprising an acrylonitrile-isobutylene resinous copolymer made from monomeric components consisting of acrylonitrile and isobutylene and having a combined acrylonitrile content ranging from 65 to 85 percent and a combined isobutylene content correspondingly ranging from 35 to 15 per cent, said copolymer being plasticized with the strong base catalyzed reaction product of acrylonitrile with a clear, viscous, resinous alkaline-catalyzed condensation product of a ketone selected from the group consisting of saturated aliphatic ketones, saturated alicyclic ketones and aromatic ketones with a molar excess ranging up to six moles per mole of said ketone of a saturated aliphatic aldehyde, the molar ratio of the acrylonitrile used in making said reaction product to the aldehyde used in making said ketone-aldehyde condensation product ranging from 0.2:1 to 2.0:1, said reaction product being a clear homogeneous substantially water-insoluble, hydrocarbon-insoluble, non-volatile resinous material soluble in acetone and in chloroform but insoluble in carbon tetrachloride and being used in an amount ranging from 5 to 20% by weight based on the weight of said resinous copolymer and said reaction product.

Polythiols

U. S. Patent 2,495,293. Samuel L. Scott, Wilmington, Del., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del., a corporation of Delaware.

A polymeric polythiol which is the reaction product of the reductive-thiolation with hydrogen and hydrogen sulfide at a temperature of 75° to 300° C. of a polymer of 1 molar equivalent of carbon monoxide and from 1 to 150 molar equivalents of a monoolefin containing from 2 to 4 carbon atoms, said polymeric polythiol having a main chain of contiguous carbon atoms and having thiol groups as lateral substituent groups thereon with the sulfur of each thiol group directly attached solely to hydrogen and to a carbon atom which is an integral part of said main chain of contiguous carbon atoms.

Flatting Agent

U. S. Patent 2,512,470. Albert Saunders, Maplewood, New Jersey, assignor to Interchemical Corporation, New York, N. Y., a corporation of Ohio.

A product suitable for use as a flatting agent comprising a metallic salt of a raw, non-pyrolyzed resin, the particles of said salt being sufficiently large that films formed from coating compositions containing said particles will have a relatively flat surface, the metal being one from the group consisting of aluminum, magnesium, calcium, strontium, barium and zinc, and said resin being a Manila gum.

A product suitable for use as a flatting agent comprising a metallic salt of a raw, non-pyrolyzed resin, the particles of said salt being sufficiently large that films formed from coating compositions containing said particles will have a relatively flat surface, the metal being one from the group consisting of aluminum, magnesium calcium, strontium, barium and zinc, and said resin being a Manila gum, and said salt being coated with a film deposited from an aqueous solution of methyl cellulose.

Corrosion Prevention

U. S. Patent 2,514,508. Leslie G. Nunn, Jr., Tulsa, Okla., assignor to Standard Oil Development Company, a corporation of Delaware.

A method for inhibiting corrosion of ferrous metal in contact with an aqueous fluid containing hydrogen sulphide which comprises incorporating in the aqueous fluid a urea formaldehyde condensation product which is at least capable of being colloidally suspended in said aqueous fluid, said condensation product being used in a small but sufficient quantity to inhibit said corrosion.

Phenolic Coating Composition

U. S. Patent 2,516,351. Jerome S. Stanford, Springfield, and Eli Perry, Indian Orchard, Mass., assignors to Monsanto Chemical Company, St. Louis, Mo., a corporation of Delaware.

A coating composition comprising an alcohol-soluble, heat-convertible phenolic resin prepared by condensing under alkaline conditions formaldehyde with a member of the group consisting of monohydric phenols, mixtures of monohydric phenols and mixtures of monohydric phenols with polyhydric phenols, the molar ratio of formaldehyde to total phenolic component being greater than 1:1, and from 5 to 15% by weight based on the phenolic resin of a soluble, fusible reaction product of an alkyd resin obtained by reaction of phthalic anhydride and a mixture of polyhydric alcohols of which the predominant constituents are dihydric alcohols, a phthalate ester of a monohydric alcohol which is compatible with said alkyd resin, and a condensation product of an aromatic sulfonamide with formaldehyde.

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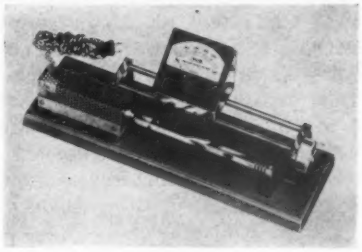


Clarkstan

MELTING POINT METER

Range, 20–500 Deg. F.

New melting point meter for the fast and accurate determination of melting points between 20° and 500° F of waxes, resins, gums, fats, tars, plastics is now available. Accurate determination of melting point may be made with a quantity of but a few milligrams of substances. With reasonable precaution samples may be recovered uncontaminated. The Clarkstan Corp., 11921 W. Pica Blvd., Los Angeles 64, Calif. PVP—January.

THREE GLYPTALS

Diversified Use

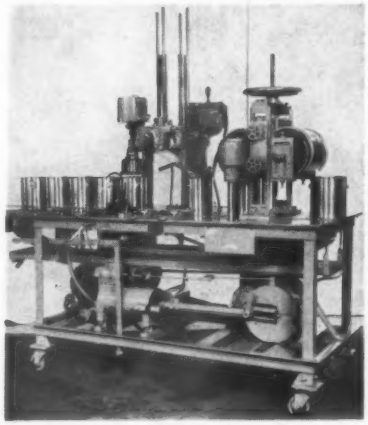
G-E Glyptal resin 2522 is a fast-drying, hard, tough resin that combines excellent adhesion and gloss- and color-retention, with chemical resistance, weather resistance, and flexibility. G-E Glyptal resin 7300 is a general purpose alkyd with improved gloss-retention designed for architectural applications, including interior gloss enamels, furniture, and exterior enamels.

Designed as a rapid, tough-baking vehicle for industrial type finishes, G-E Glyptal resin 7310 has excellent weather resistance, increased color-retention, and is recommended for a wide variety of metal products including farm machinery, machine tools, and gasoline pumps. It may also be used for air-drying enamels. General Electric Co., Chemical Dept., Pittsfield Mass. PVP—January.

PAINT FILLER

Automatic

Above unit fills paints and allied products, places covers, and seals cans, in sizes ranging one thirty-second to and including gallons, completely automatic. According to the manufacturer, quick change over and ease of cleaning are additional features of this model. Elgin Manufacturing Co., 200 Brook St., Elgin, Ill. PVP—January.



Elgin

FLATTING AGENT

Economical

In response to a demand for an economical lacquer flatting agent which would give positive control over the degree of matte finishes obtained, and which would not deteriorate film properties, Syloid 308 is offered.

Syloid is a synthetic silica, and it is reported that the particle size of this material can be controlled from batch to batch, thus assuring uniform results. In addition, Syloid 308 is said to have a high flatting efficiency and because it quickly and readily mixes in the mills with other lacquer constituents, "high mill loading" is possible with this material. The Davison Chemical Corp., Baltimore 3, Md. PVP—January.

THICKENING AGENT

Useful in Water Paints

Sodium cellulose sulfate is a water soluble cellulosic, which when added to water increase the viscosity of the ensuing solution rapidly. A solution containing 2–3% of this material is so thick that it can hardly be poured. In addition, sodium cellulose sulfate has film forming properties and is recommended for use in water based paints and as a thickening agent in emulsion paints. Tennessee Eastman Corp., Kingsport, Tenn. PVP—January.

ELECTRIC LIFT TRUCK

3-Way Operating Positions

Improvements in the "load mobile" include: (1) A high-low switch is now provided for easier maneuverability in close quarters. (2) Spring-mounted casters have been added to increase stability. (3) Freer use of sealed ball-bearings in the control system means that just a light touch on the foot pedal is all that's needed to put it in required positions. (4) Heavy roller chain operates the brake instead of an enclosed cable. (5) Hydraulic lifting mechanism is arranged in a vertical position at the front end of the hood where it is less likely to be damaged in transit over rough floors. Market Forge Co., Everett, Mass. PVP—January.

Market Forge

NEW PRODUCTS

HEAT STABILIZER

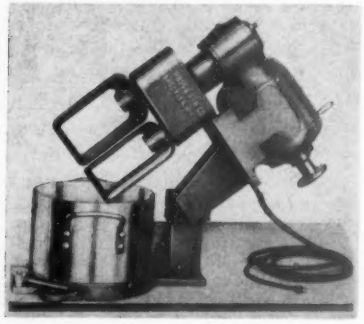
For Vinyls

High lead content primary heat stabilizer and internal lubricant for polyvinyl chloride resins and copolymers is now available. According to the manufacturer, this stabilizer will fulfill the total heat protective requirements of most vinyl compounds in which lead salts are suitable. Called Witco Lead Stearate #50, this new stabilizer does not melt at mixing temperatures, it disperses in the resin in solid particle form, similar to a pigment, thereby reducing to a minimum the possibilty of a stabilizer spewing. Witco Chemical Co., 295 Madison Ave., New York, N. Y. PVP—January.

CHANGE CAN MIXER

For Pilot Runs

For mixing small laboratory batches of from 1 quart to 1½ gallons of material, the new #130-EL Motor Driven Laboratory Change Can Mixer is offered.



This new mixer is reported to mix efficiently most varieties and consistencies of materials, and is available in 1-gallon or 2-gallon capacity sizes. The unit, which can be run on ordinary light circuit, facilitates determination of formulae and other details in pilot sizes prior to production cycles. The mixer is very flexible, having a variable speed motor which permits stirrer speeds within a wide range of RPM'S. The direction of rotation can be reversed. The double motion stirrers revolve on their own axis and simultaneously around the circumference of the can, assuring a homogeneous mix in minimum time. Charles Ross & Son Co., 156 Classon Ave., Brooklyn 5, N. Y. PVP—January.

GLYCOL BORI-BORATE

Glycerine Substitute

Aquaresin (Glycol Bori-Borate) is an odorless, viscous, colorless, nondrying, hygroscopic liquid. The pH of its 5% aqueous dispersion is 8–8.4. Its specific gravity is 1.37. It is completely soluble in water, methanol, glycerin and the glycols. It is insoluble in oils and hydrocarbons. It is non-inflammable and not subject to bacterial or enzymic decomposition. Aquaresin is being used as a softener and plasticizer for glue, gelatin and water soluble gums. Glyco Products Co., Inc. 266 Court St., Brooklyn 2, N. Y. PVP—January.

VISCOMETER ADAPTER

Gives Precise Measurements

The UL Adapter consists essentially of a cylindrical spindle mounted symetrically with a concentric tube. When attached to LV Models of the Brookfield Viscometer, it gives full scale (13½") deflections representing 10 centipoise at 60 RPM, 20 centipoises at 30 RPM, 50 centipoises at 12 RPM, and 100 centipoises at 6 RPM. Thus, because of the amplifying effects provided when measuring viscosities within the range of 0 to 10 centipoises, reproducibility within .02 centipoises is obtainable. Brookfield Engineering Laboratories, Stoughton, Mass. PVP—January.

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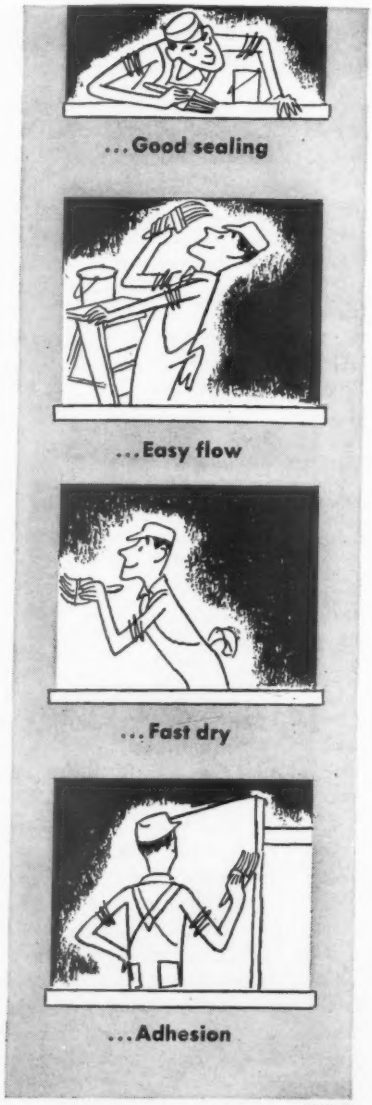

IC50-7

WAX EMULSIONS

(*From page 17*)

Carnauba Wax

Carnauba wax is of vegetable origin and occurs as a fine powder on the leaves of the Corypha Cerifera, which is a palm tree existing in Brazil and neighboring South American countries. The leaves are removed from the palm during the months of September to March. They are allowed to dry in the sun. The powdered mass is brushed and scraped from the leaves and placed in vats of boiling water. The wax floats to the surface and is thus collected. This product is very crude and dirty greenish and yellow in color. Refining consists of remelting in water and removing all twigs, bark, and other foreign matter. The color is improved by treating with chemicals and bleaching earths. The wax is tough, lustrous, hard, and has an amorphous structure. It consists mainly of myricyl cerotate in conjunction with small amounts of myricyl alcohol and free cerotic acid. Commercially it is marketed as #1 Yellow, #2 Yellow, #2 North Country, #3 North Country, #3 North Country Refined, and #3 Chalky. When heated it has an aromatic odor.

Montan Wax

This wax is a product extracted from lignites found in Central Europe. Its main constituents are chiefly monohydric alcohol esters and acids of high molecular weight. It is sometimes substituted for carnauba and beeswax. For some purposes it is preferred to carnauba wax owing to its lighter color. The crude wax is dark brown in color, but distillation by super-heated steam produces a nearly white product.

Ouricury Wax

Ouricury wax is obtained from the leaves of the palm called "Ouricury" located in Brazil. The wax is similar to carnauba wax. It is used as a substitute for carnauba in floor polishes and other sundry items.

Beeswax

This is an insect wax, and is produced by the common honey bee called Apis Mellifica. It is prepared by melting the honeycombs, where it was used by the bees in the process of building, in hot water and the wax skimmed off. The crude wax is then remelted and filtered. Repeated melting in water and exposure to sunlight will produce a nearly white product. Mild oxidizing agents are sometimes used in the bleaching process. Beeswax consists chiefly of cerotic, melissic, palmitic acids, and myricyl alcohol. It is used mainly in furniture and paste waxes for floors although a small amount finds its way in non-rubbing floor polishes, mainly to obtain special properties such as non-slip. In producing a non-slip film one must use caution in not adding too much, for that will result in a polish that will smudge easily and therefore present an untidy appearance.

Columbia to Hold Conference On Industrial Personnel

A "Conference on Industrial Personnel" at Columbia University will be held March 19 to 23, 1951, it was announced by Professor William W. Waite, head of Personnel Area of the Columbia Department of Industrial Engineering, and Director of the Conference.

Under the theme of "The Frontiers of Personnel Administration," certain new concepts of personnel administration will be presented in lectures and round-table clinic discussions between authorities on various phases of personnel administration and representatives of approximately fifty leading industrial and business concerns. Many of these new concepts and ideas have been tested experimentally in certain industrial organizations but have not as yet been widely publicized or their advantages realized on a broad front.

Help In Formulas Affected By Cobalt Drier Cut

Restrictions on cobalt mean reformulation of drier contents. This may (1) increase the possibilities for loss of drying power in certain of your paints during shelf storage; (2) tend to cause softer films resulting in higher susceptibility to mildew attack.

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N. Y. U. SYMPOSIUM

PROTECTION of submerged surfaces and recent developments in the field of organic chemistry featured the third Paint and Varnish Symposium sponsored by the College of Engineering, New York University on November 18th.

The protection of submerged steel structures through the use of asphaltic and bituminous coatings was discussed by C. W. Oxley of the Standard Oil Development Co. Through the experiences of the oil industry, it has been found that such coatings with thicknesses ranging 1/32"–1/16" have worked very well in protecting steel under water.

Mr. Oxley also stated that zinc silicate paints have proven very satisfactory in combatting corrosion. Vinyls have been given considerable attention during recent years, he further stated, in the protection of steel against rust and corrosion. Other products discussed were thixotropic coal tar products applied under pressure, heat-hardened phenolics and metallic coatings.

In discussing the influence of the vehicle and its effect on coating materials, Dr. A. C. Elm of the New Jersey Zinc Co. pointed out the importance of the molecular structure of protective films. He showed how the water resistance of a film can be achieved through the elimination of hydroxy and carboxy groups. Other factors covered were the effect of osmotic pressure and electrolytic potential across the film. Opinion was that it was more important for a paint film to be anti-corrosive rather than water-resistant.

"Mildewing of Paints and Its Prevention" by Richard E. Vicklund and Milton Manowitz of the Engineer Research and Development Laboratories was also included in the colloquium.

Among the numerous, inescapable deteriorating factors which account for huge losses of materials and equipment are fungi and moisture.

The fungi most prevalent on painted surfaces were once believed to be Aspergillae and Penicillia; however, recent studies of buildings in New Jersey, Florida, and Texas show that while these organisms are frequently found, the genus Pullularia is the most frequently occurring fungus on paints.

In the development of test methods of evaluating fungicidal paints, this laboratory studied numerous fungi before selecting Aspergillus oryzae as the primary organism; it reacts to various fungicidal paints in a manner very similar to Pullularia and is easier to work with in the laboratory.

In addition to the problem of selecting appropriate test organisms, a satisfactory substrate for the application of the test paint was found in the use of filter paper since it is uniform and absorbs moisture which is essential to mold growth.

Various studies have been conducted to determine the mildew resistance of the ingredients generally used in paint formulations.

Of the many compounds that have been tested, the phenyl mercurials, chlorinated phenols, and recently, copper 8-quinolinolate have been found to be the most effective. The paper discusses the characteristics of these compounds in paint coatings.

F. E. Kulman of the Consolidated Edison Company spoke on "Coatings for Underground Cables and Pipes."

He described coatings and coating practices being used on the underground cable and gas piping systems of the Consolidated Edison Company of New York, Inc. and the conditions under which these coatings are installed and operating.

Following a survey of the causes of underground corrosion, the requirements which a protective coating must meet were listed. The advantages and limitations of existing coatings were evaluated against these reqirements and newer developments were indicated. Experience shows that thickness is an important factor in coatings.

For the purpose of the discussion, the three parts of the paper were devoted to a) lead sheath cables in ducts, b) buried gas pipes, and c) pipe type feeders.

V. A. Veit of the same company presented an interesting paper on the "Protective Coatings of Submerged Type Transformers and Network Protectors."

This paper outlined the experience of protection obtained by the Consolidated Edison Company of New York, Inc. with the various coatings now in use on this apparatus and stresses the need of a much more endurable coating.

Included are descriptions of the apparatus, typical installations, exposures encountered and actual cases of coatings failure. The repainting of this apparatus by the flow method is described along with the procedure used for making comparative tests of protective coatings for the apparatus.

Other phases covered were surface preparation and basic principles of cathodic protection as essential aids in the successful application of protective coatings.

Dr. Allen Alexander, Head of the Protective Coatings Branch, Naval Research Laboratory presided at the colloquium on protection of submerged surfaces.

The session dealing with developments in organic coating chemistry was highlighted by two interesting papers, "Comparative Oxidation of Drying and Semi-Drying Oils by P. S. Hess and G. O'Hare, Congoleum-Nairn, Inc., and "Further Investigation on the Solid State of Film Forming Materials" by Dr. Max Kronstein.

The first paper dealt with the effects which variables such as temperature, agitation, and air flow exert on the bulk oxy-polymerization of vegetable oils.

Left to right: A. J. Liebman of Dravo Corp., A. W. Van Heuckeroth of Corps of Engineers, Dr. Max Kronstein of New York University, Dr. G. W. Oxley of Standard Oil Development Co., F. E. Kulman of Consolidated Edison, Dr. A. C. Elm of New Jersey Zinc, V. A. Veit of Consolidated Edison, Dr. Allen Alexander of United States Navy Research Laboratories.

Emphasis was placed upon differences in oxidation behavior of linseed, soybean, safflower, dehydrated castor oil, and others. Data concerning viscosity, dielectric constant, power factor, oxygen up-take, and molecular weight changes were given as well as spectrophotometric analysis for the raw and blown oils. Inferential theoretical assumptions derived from the experimental data were also presented.

In presenting his paper on "Further Investigation on the Solid State of Film Forming Materials," Dr. Kronstein reviewed his earlier findings on the characteristic changes in the X-ray diffraction spectrum of oils during their insolubilization and extended these results to other film-forming materials such as alkyd gels, waxes, certain forms of styrene, etc.

The solidification of different oils progresses differently, whereby those oils, which have a greater tendency to solidify, pass more easily through the coherent gel state into the incoherent solid state than other oils. The comparative heat endurance of the coherent gel substances of tungoil and linseed oil was discussed.

The catalytic effect of anhydrous ferric chloride and of titanium tetrachloride on tungoil is discussed. In spite of a very much shortened induction period on a low gelling temperature, products of a high percentage of insoluble solids were obtained. It has been shown by the use of infrared spectroscopy that hereby the metals do not enter permanently the insoluble oil-solids, since no metal lines become visible in their spectrum. This has been confirmd by organic analysis.

Earlier, the author showed that the isolated solids of tungoil are still capable of increasing their oxygen content. The present work shows that they can form new reaction products with such products as allyl-mercaptan or alkyl and aryl-trichlorosilanes, whereby the sulfur or silicon content of the new product can be determined by organic analysis.

Work on the possible utilization of this available unsaturation is being continued.

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Canadian High Polymer Forum

The 3rd Canadian High Polymer Forum is to be held in May 1951 at the Royal Military College in Kingston, Ont. according to an announcement made by Dr. Harry Sheffer, program director of the Forum. Sponsored by The Chemical Institute of Canada, this Forum also has the support of the National Research Council of Canada.

Forum officials are planning to include in their program a series of short papers to cover as wide a range of subjects as possible. Any subject will be considered that deals with the science of large molecules—this would take in: pulp and paper, rubber, natural polymers, plastics, textiles, protective coatings, and other fields.

One of the guest speakers at the Forum will be Dr. H. M. Spurlin of Hercules Powder Company, Wilmington, Del. who is an internationally known authority on the solubility of high polymers.

Prospective authors of papers are requested to submit tentative titles before January 1, 1951 to Dr. Sheffer at Defence Research Chemical Laboratories, Ottawa, Ont. Other officials of the Forum are: Dr. O. F. Denstedt, chairman; and Dr. S. Bywater, secretary-treasurer.

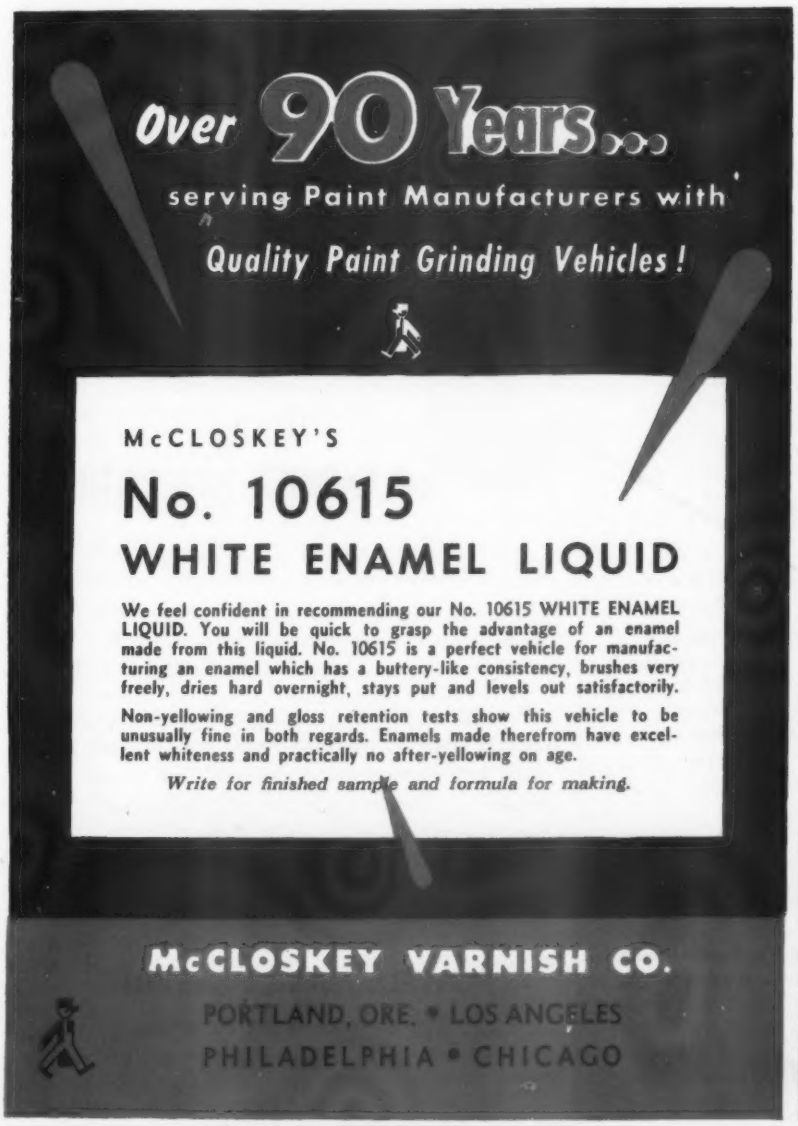
•

N. Y. Production Club Christmas Party

The New York Paint and Varnish Club held its annual Christmas Party at the Building Trades Employers' Association Friday December 8th. A capacity crowd of members and guests started festivities off in high style. An excellent turkey dinner was served including all the trimings.

Harold Davis of the D. H. Litter Co. presented Pres. Ralph Charlton with an inscribed gavel in behalf of the Nuodex Co. An excellent, varied bill of entertainment followed. The acts were clever and well presented.

The sweepstakes prizes followed and wound up the evening activities. There were a great many wonderful gifts given out, many of them donated by raw material suppliers.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E. W. Winslow

E. W. Winslow of G. E. Wins Witco Prize

Witco Chemical Company has recently announced that E. W. Winslow, in charge of advertising and promotion for General Electric's Chemical Products Division, is the winner of the Philco television receiver awarded at the Paint Production Show in the Congress Hotel, Chicago, November 9–11, for the closest guess as to the weight of Witco Cobalt Naphthenate contained in a glass container exhibited in Witco's booth at the show.

The correct weight was 389.7 grams and Mr. Winslow guessed 5381 grams. Witco Chemical Company officials said that 1,120 persons took part in the guessing contest. Mr. Winslow is at the Pittsfield, Mass. plant of General Electric.

Archer-Daniels-Midland Promotions

Promotion of two executives of Archer-Daniels-Midland Company has been announced by T. L. Daniels, president of the Minneapolis firm.

Ellis D. English, president of Commander-Larabee Milling Company and vice-president of Archer-Daniels-Midland Company, was elected to the Board of Directors of ADM at a recent meeting of the stockholders.

Election of W. G. Andrews to the position of assistant vice-president of Archer-Daniels-Midland was also announced. A graduate of Carleton College and the University of Pittsburgh Graduate School, Andrews joined ADM as a control chemist nine years ago.

Amsco Names Thomas Barker

Edward M. Toby, Jr., President of American Mineral Spirits Company, announced further expansion of Amsco's sales staff in the southeastern territory. He reported that Thomas Barker, with diversified technical experience in the petroleum industry, has joined Amsco's organization. He is located at the company's office at 254 Paces Ferry Road, N. E., Atlanta, Georgia.

Materials Handling Show To Feature Outdoor Equip.

New developments in outdoor materials handling equipment will be the big feature of the Materials Handling Exposition, scheduled for the International Amphitheatre, Chicago, April 30–May 4. The impact on industrial management of this new emphasis on outdoor exhibits is expected to be even greater than the effect of the first indoor show four years ago.

Lester K. Ross

L. K. Ross to Cover Great Lakes Region for Charles Ross & Son

Lester K. Ross, vice-president of Charles Ross & Son Company, Brooklyn, N. Y., manufacturers of mixing, grinding, kneading, and milling equipment for the ink, paint, chemical and allied industries, has taken over sales representation for the Great Lakes Region.

Active for over 25 years in the Charles Ross Company, Lester K. Ross is widely known for his experience with these types of equipment. He will be available for consultation to any firm considering new machinery, and will also direct and supervise sales and service in the heavy industrialized Great Lakes states, including the cities of Syracuse, Rochester, Buffalo, Niagara Falls, Toledo, Detroit and others in the region.

Commonwealth Varnish Announces Changes

Changes in the ownership and management of Commonwealth Varnish Company, 4124 W. Parker Avenue, Chicago, were announced recently.

New officers of the company are Richard P. Edmonds, President, and George R. Frederick, Secretary and Treasurer. Both T. C. Thorsness and William Thorsness have severed all connections with the company.

Canadian Protective Coatings Conference Scheduled for Mar. 16th.

The Protective Coatings Division of The Chemical Institute of Canada will hold its 5th Annual Regional Conference at the Royal York Hotel in Toronto, on Friday, March 16, 1951. Arrangements are rapidly approaching completion and advance interest indicates the meeting will be well attended, according to T.H.G. Michael, chairman of the Division.

V. H. Vedda Made Plant Supt. at A. C. Horn Co.

V. H. Vedda has recently been appointed plant superintendent of the A. C. Horn Co., according to an announcement by W. V. Keegan, Special Ass't. to the President. Mr. Vedda's first position with A. C. Horn was in 1947 when he was appointed head of the Raw Material Control section. In 1948 he was promoted to supervisor of Mixing and Grinding Operations.

Prior to his connection with A. C. Horn, Mr. Vedda was associate head of the Insulation Dept. of Centro Research Laboratories. His first position in the paint industry was with the Insul-X Co. where he worked as a resin chemist. Mr. Vedda received his education at Columbia University and graduated in 1942 with a B.S. degree.

V. H. Vedda

E. D. Peck Appointed Mgr. of PPG Brush Div.

E. D. Peck, general paint manager for Pittsburgh Plate Glass Company, has been appointed general manager of the firm's brush division.

Mr. Peck has served as general paint manager since 1939 and the new appointment involves no change in his function as general paint manager. His headquarters are at the firm's general offices in Pittsburgh.

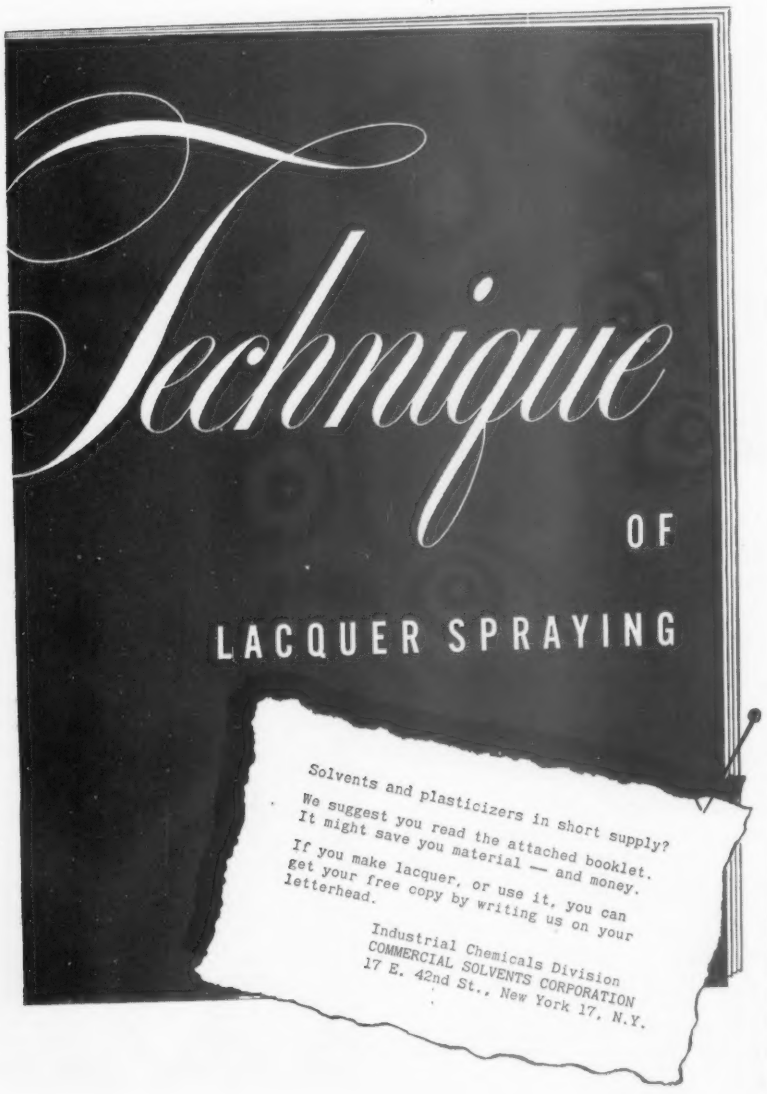
Chemical Institute to Hold Annual Conference, June 18–20

The Chemical Institute of Canada will hold its 34th annual conference in Winnipeg, June 18 to 20, 1951. Arrangements are well underway for a successful meeting and advance interest indicates this conference will be among the largest ever held by the Institute in Western Canada.

•

National Lead Names A. H. Drewes Director

National Lead Company named Alfred H. Drewes a director and member of the executive committee. Mr. Drewes is assistant to the president of the company and a director of Baker Castor Oil Company and of Titanium Metals Corporation of America.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N.Y.U. Transfers Paint Course Downtown

In response to many requests, New York University College of Engineering will transfer its graduate course (Ch. E. 174–175) from University Heights to Washington Square beginning with the Spring term.

The course will be under the direction of Adjunct Associate Professor Max Kronstein and will be given on Wednesday evenings from 6:00 to 8:00 P.M. The course will cover principles in protective, decorative, and functional finishing; economic factors; finishing problems, types of surfaces, types of finishes, methods of application; specifications and test methods; research, production and control methods; and advanced finishing problems.

The new arrangements for giving the surface finishes lecture course at Washington Square were made in order to facilitate attendance for men who are employed in the metropolitan area. Two other courses, surface finishes laboratory (Ch. E. 176–179) and surface finishes research (Ch. E. 301–302), will continue to be given at University Heights.

Registration for all surface finishes courses (Spring Term) will take place on January 24, 25, and 26 in South Hall, University Heights campus, 181st Street and University Ave., Bronx, from 6:30 to 8:30 P.M. Applications and additional information may be obtained from Henry J. Masson, Assistant Dean, Graduate Division, New York University College of Engineering, New York 53, N. Y.

•

Large Alkyd Resin Kettle Designed for Jones-Dabney

One of the world's largest single kettle alkyd resin production units is being designed and constructed for the Jones-Dabney Division of the Devoe & Raynolds Company at Louisville, Kentucky, by the Chemical Plants Division, Blaw-Knox Construction Company, Pittsburgh, Pa. This new unit includes many unique features which increase production capacity, improve process control, and raise product quality. The processing equipment is to be constructed of stainless steel and heated and cooled by Dowtherm.

•

Paraffine Companies Now Known as Pabco Products

The Paraffine Companies have announced that the name of their Company has been changed to Pabco Products Inc. effective November first. Head offices are located at 475 Brannan St., San Francisco, Calif.

Stanley D. Rogaliner

Rogaliner New Falk V.P. In Charge of Resin Sales

The appointment of Stanley D. Rogaliner to Vice President in Charge of Sales of Resins and Specialty Products has been announced by Falk & Company president, Louis J. Reizenstein. Mr. Rogaliner, formerly secretary of Falk & Co., has been with the company since 1937. He will continue to make Pittsburgh his headquarters with offices at Falk's Carnegie Plant.

•

Dr. W. C. Dearing Joins Koppers Research Dept.

Dr. William C. Dearing, former Director of Research for the Plaskon Division of Libby-Owens-Ford Glass Co., has joined the Research Department of Koppers Company, Inc., it was announced recently by Dr. G. F. D'Alelio, vice president and manager of the research department.

•

Commercial Solvents Names New Director

Maynard C. Wheeler, vice president in charge of production of Commercial Solvents Corporation, has been elected to the Corporation's Board of Directors, it was announced by Major T. P. Walker, chairman of the board.

Mr. Wheeler joined Commercial Solvents in 1923 as a chemical engineer. He became Manager of the Terre Haute plant in 1929, and later, production manager for all CSC plants. In 1945 he was made vice president in charge of production.

Glidden to Expand Naval Stores Div.

Plans for the expansion of the Naval Stores Division of the Glidden Company in Jacksonville, Fla., were announced by Paul E. Sprague, Glidden vice president.

Designed to increase production capacity of various new products by 30 to 50 per cent, the first step in the program is an immediate investment of $200,000 in new facilities. A continuous increase in sales and the development of these products has made the expansion necessary, according to Mr. Sprague.

Substantial improvements in Glidden's pinewood distillation department are also included in the program which will take several years to complete.

Eakins Color Names West Coast Representative

J. S. & W. R. Eakins, Inc. of Brooklyn, New York announces that Cole & DeGraf, 417 Market St., San Francisco 5, Calif., and Frederick C. Ford, General Motors Bldg., Detroit 2, Mich., have been appointed as representatives for Eakins dry colors.

•

Monsanto Appoints Thurmond

Charles D. Thurmond has been appointed assistant development director of Monsanto Chemical Company's western division. He joined Monsanto in 1944 as a member of the development department, organic chemicals division in St. Louis. His headquarters are in Seattle.

NEW in Economy, Efficiency, Uniformity

Davison announces Syloid 308, a new flatting agent of tremendous importance to all manufacturers of flat-finish lacquers. This is a synthetic silica, inert and insoluble, with particle size minutely controlled to assure uniformity. Every shipment you get is exactly like every other, and so the results are always the same. This sets new standards in flatting efficiency, mill room economy, and film characteristics. Use our technical advisory staff. Write for information.

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TECHNICAL Bulletins

REGULATOR FOLDER

A new 4-page folder is available from Spence Engineering Company, Inc., Walden, New York which gives useful information on temperature regulators, pressure regulators, and desuperheaters.

A complete explanation of the principles of pilot-operated regulating valves is given in this folder in addition to data and illustrations of 27 Spence pilots.

KEY TO GOV. SPECS

The rapidly accelerating defense program means more protective coating for government specifications with all the resultant time consuming studies and operations. In view of the many changes which have taken place in the grouping together of numerous military branch agency specifications under one code, many manufacturers have been a bit confused or have not as yet familiarized themselves with the new system. Thus, "Key To Government Specifications" was worked out by U. S. Industrial Chemicals, Inc. This key was abstracted from Circular No. 743 issued by the Scientific Section of the National Paint, Varnish and Lacquer Association, and is a cross index which enables one to identify the new prefixes or codes with the proper government agency. As an additional time saver, U. S. Industrial Chemicals has also compiled into one group the designated agencies addresses from which to procure specifications. U. S. Industrial Chemicals, Inc., 60 E. 42nd St., New York 17, N. Y.

PHOSPHATE PROCESSES

This 12 page bulletin describes phosphate coating chemicals and processes for paint-bonding and rust proofing. Paint bonding of steel, zinc, and aluminum using the spray, immersion and brush processes are discussed in detail. American Chemical Paint Co., Ambler, Pa.

PAINT MILLS

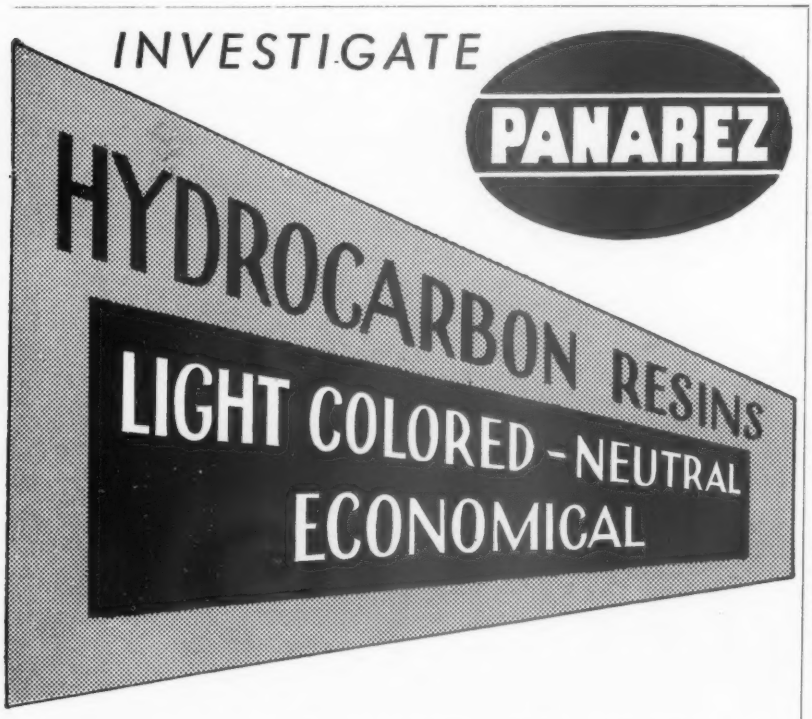
Four page folder describes the Lehmann Models 631-V and 632-V Three Roll Paint Mills with Sight-O-Matic control. Included are discussions on the Pneumatic Discharge Control and Rol Temperature Control and specifications for both these mills. J. M. Lehmann Co., Inc., Lyndhurst, N. J.

DATA ON MACHINE REPLACEMENTS

A new 4-page folder titled "What Do You Do When A Machine Is Worn Out" is available from V. W. Palen, Bureau of Public Information, New York University College of Engineering, New York 53, N. Y. Enclose 10¢ to cover cost of handling and mailing.

The text material was prepared by Frank Gryna, Jr., Department of Administrative Engineering, New York University College of Engineering. The folder tells when to scrap old machines before they become liabilities. It also considers such factors as first cost, product requirements, operating costs, what competition is using, space limitations, employee safety and effect on workers.

The illustrated folder lists a set of twelve questions and answers and includes case examples showing cost comparisons, estimates of the future, and annual cost computations.



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SPECTROCHEMICAL DATA

This comprehensive report, which should be of widespread interest and service to all those interested in spectrochemical analysis, analytical chemistry, and allied fields, provides in a form for ready reference current information on spectrochemical standard samples. This latest report, compiled by Subcommittee IV on Standards and Pure Materials of ASTM Committee E-2 on Emission Spectroscopy, extends and replaces information given in a publication prepared by Messrs. Brode and Scribner, issued by ASTM in 1944 and revised in 1947. The rapid growth of spectrochemical analysis and a corresponding increase in available standard samples call for a periodic compilation of types and sources of standards for the information of analysts.

Copies of this 36-page report (Technical Publication No. 58 B)—in heavy paper cover—can be obtained from American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa., at $1.25 each.

COATINGS & ADHESIVES

Thirty-two page catalog tabulates properties of over 100 industrial adhesives, coatings, and sealers. The booklet states the availability of over 1000 formulas and offers research help for industries selecting the correct product.

Included in this bulletin are tables covering both permanent and strippable coatings for protecting metal against abrasion and corrosion, for sound deadening and adhesives and sealers for all purposes. Write to the Minnesota Mining and Manufacturing Co. 900 Fauquier St., St. Paul, Minn. and request "3M Adhesives, Sealers, and Coatings."

EPON RESINS

This 20-page brochure contains information on Epon resins and their use in surface coatings. Included is a discussion on the outstanding properties of these resins together with their general chemical and physical properties. Recommended formulations for baking enamels and varnishes, and air dry brushing enamels are presented. Shell Chemical Corp., 500 Fifth Ave., New York 18, N. Y.

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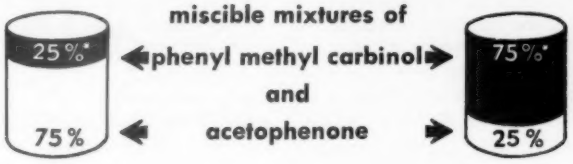

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abstracts

Alkyd Resins Comprising Ether Alcohols of Bisphenol

H. M. Hoogsteen, A. E. Young, and F. J. Buege, The Dow Chemical Co., Midland, Mich. Presented at Div. of Paint, Varnish, and Plastics Chemistry of the American Chemical Society at Chicago Meeting, Sept. 3–8, 1950.

The use of bisphenol with formaldehyde and rosin in the synthesis of valuable coating materials is well known. A more recent development in the chemical modification of bisphenol consists in its reaction with alkylene oxides or olefin halohydrins to produce hydroxy alkyl ethers of bisphenol.

The work summarized in this study is concerned primarily with the hydroxy propyl ether of bisphenol, because it is commercially available. The designation X565 is used to replace the chemical nomenclature, 1,1-isopropylidene bis (*p*-phenyleneoxy) di-2-propanol. The use of X565 with pentaerythritol in the formulation of a series of soybean alkyds constitutes the subject of this paper.

Resins were prepared comprising combinations of X565, pentaerythritol, phthalic anhydride, and soybean oil. The X565 phthalate content was varied while maintaining a constant ratio of pentaerythritol phthalate and soya bean oil. Two ratios were selected, 0.493 and 0.754, in the preparation of two series of resins. The oil alcoholysis method was employed in the preparation of the alkyds.

Films of the X565 alkyds were prepared and various properties evaluated. The data indicate that the use of X565 in the formulation of pentaerythritol-soya bean alkyds results in a marked improvement in the alkali resistance of the resin films. In addition it is demonstrated that the X565-pentaerythritol alkyds possess excellent durability.

Frosting and Gas Checking of Conjugated Drying Oils

Dannenberg, Hans, Wagers, J. K. and Bradley, T. F., Industrial and Engineering Chemistry, 42(8): 1594–1599, 1950.

Drying oils containing conjugated carbon to carbon bonds are known to undergo "frosting" and checking in the process of drying. The study of conditions that induce "frosting" and "checking" was the object of this work.

Predrying below 0.5 hour yielded smooth films, longer period resulted in defective finishes. The "checking" and "frosting" under various gases were shown to be due to fine particles present in the atmosphere; properly filtered atmosphere showing no effect on the finish. Small amounts of calcium octoate and calcium salts of phenolic resins control "frosting" and "checking." The authors suggest additional industrial control measures such as:

1. Avoiding exposure of freshly coated surface to dust or smoke laden air.
2. Adjusting burners in ovens so that no soot is formed.
3. Addition of small amounts of certain active agents to the varnish in order to decrease the initial surface tension.

New Resinous Compositions

Don E. Floyd, Wesley A. Jordon, Ralph H. Manley, and John G. Benjamin, General Mills, Inc., Minneapolis, Minn. Presented at Div. of Paint, Varnish, and Plastics Chemistry of the American Chemical Society at Chicago Meeting, Sept. 3–8, 1950.

A new resinous composition, made up largely of the monoglyceride esters of abietic and linoleic acids, has been prepared. This material is a viscous, noncrystallizing liquid which is soluble in many organic solvents and compatible with fatty acids and fatty oils. For convenience, the new product is called resinous alcohol.

The resinous alcohol contains free hydroxyl groups and reactive conjugated double bonds. The principal reactions it undergoes are esterification by acids or anhydrides and addition with reagents such as maleic anhydride. The physical and chemical properties of the resinous alcohol are such that it is particularly adapted for use in preparing new varnishes and alkyd-resins.

Because it is a liquid which can be poured at room temperature or pumped with slight warming, and it is compatible with fatty acids and oils, the resinous alcohol is safe and convenient to use. Agitation is not required and the open-kettle process for varnish or alkyd

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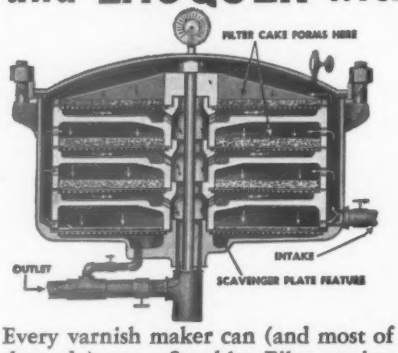

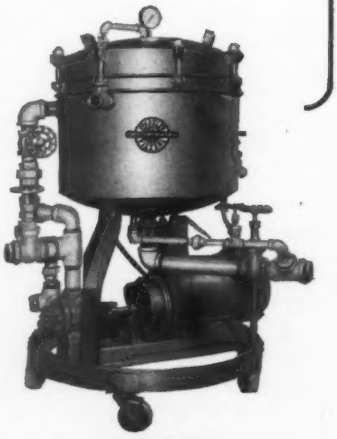

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manufacture is entirely suitable. Use of the resinous alcohol eliminates formation of dark varnish from the settling of solid resin to the bottom of the kettle.

Chemically, the resinous alcohol may be considered to be a polyhydric alcohol, containing resin and unsaturated fatty acids in combined form. By using it in conjunction with maleic anhydride, it is possible to incorporate three kinds of resin into a varnish: the natural resin present in the resinous alcohol, the maleic resin adduct, and the alkyd resin formed during reaction. Varnishes and alkyd resins of high quality can be prepared in this manner from soybean oil, maleic anhydride, and the resinous alcohol.

Porosity of Paint Films

Wolock, I. and Harris, B. L., Industrial and Engineering Chemistry 42 (7) 1347–1349, 1950.

The authors attempt to indicate the use of Krypton in surface area measurement on samples of not more than 1000 sq. cm. of total surface area, featuring adsorption studies of unsupported linseed oil films. It is claimed by these authors that the results of their work has resulted in the following conclusions.

1. Due to the observance of very low factor of roughness, there is no appreciable quantity of discrete fine pores in unsupported linseed oil films.

2. Subsequent treatment of films with acetone resulted in approximately the same weight loss for films of different thicknesses as well as very little increase in surface area.

The authors decided to determine whether pores actually existed in unsupported films by measuring the entire surface area of these films of known geometrical area. It is known that the presence of fine pores in unsupported films will increase the total area, as compared over an area measured for the same film without pores. The technique employed for the measurement of areas of these unsupported films, was that of the general method of Brunauer, Emmett and Teller (BET), employing the gaseous adsorption of Krypton at –195° C.

Briefly, this is done by measuring the amount of gas the sample physically adsorbs at varying relative pressures at a temperature near the boiling point of the gas. Employing data as a result from the gaseous adsorption of Krypton, a BET plot is constructed from which the volume equivalent to a monolayer of unsupported film on the surface of the sample is obtained. If the area occupied by an absorbed molecule in the monolayer is known, the surface area of the sample can then be calculated.

Rosin-Modified Phenolics

P. O. Powers, Battelle Memorial Institute, Columbus, Ohio. Presented at Div. of Paint, Varnish, and Plastics Chemistry of the American Chemical Society at Chicago Meeting, Sept. 3–8, 1950.

The rosin-modified phenolic resins have achieved an important place among the hard resins in the paint and varnish and printing ink fields.

Consideration of the resin acids present in gum and wood rosin and in various processed resins suggests that two double bonds must be present in the resin acid structure to be reactive with phenol-formaldehyde condensates. There appears to be good evidence that the phenolic resin adds to rosin. However, the structure of the addition product has not been clearly established. The nature of the addition product of phenol-formaldehyde resins with the drying oils is still undecided, but it is clear that only acids with two or more double bonds add readily, and that conjugated forms are more active.

The commercial resins are formed by esterifying, with glycerol or pentaerythritol, the condensates of a phenol-formaldehyde resin with gum or wood rosin.

Melting point, viscosity, and solubility depend on the amount of phenolic resin employed or on the phenolic compounds used in its preparation. The higher melting resins are used with linseed and the soft oils, while lower melting, more soluble resins must be used with tung oil. Oil-modified phenolics are used where a high degree of water and chemical resistance is required.

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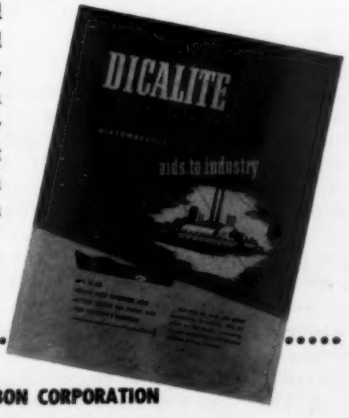
Three grades, Dicalite L-1, L-2 and L-10, are available. The principal difference is in particle size, with 8%, 3% and 15% respectively retained on 325 mesh screen. Dicalite White Filler is practically the same material, but with only 1% retained on 325 mesh screen. All are white, high brightness materials.



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Effect of Temperature in the Oxidation of Linseed Oil.

Hess, P. S. and O'Hare, G. A., Industrial and Engineering Chemistry 42 (7), 1424–1431, 1950.

This paper deals with the effects which differences in reaction temperature have on the induction period (period of inhibited oxidative polymerization) and bulk oxypolymerization of the raw linseed oil. Oxidation was carried out with otherwise constant conditions (i.e. agitation, airflow, etc.). The oil was then analyzed for the following: viscosity, peroxide value, ultraviolet absorption, dielectric constant, power factor, oxygen content, refractive index and iodine value. Within a certain temperature range, the initial rate of viscosity increase at different temperatures for the oxypolymerization reaction is the same (80°–200° C). At a point in oxidation, there is a change in the rate of viscosity increase. From this, three temperature ranges were characterized. Above 130° C there is practically no induction period, from 84°–130° C the length of the induction period increases logarithmically as the temperature is lowered, below 84° C there is a very long induction period. The peroxide value (maximum) is a function of the temperature —higher values resulting from lower reaction temperatures.

The results obtained in this study corroborate the free radical propagation theory of oil oxidation. There are indications of the formation of an intermediate prior to oxidative molecular weight build-up. The authors suggest that this intermediate may be of the chelate type. Association of intermediates may be partially responsible for molecular weight build-up.

Tall Oil and Rosins in Toxic Paint Vehicles

Alexander, A. L., Benemelis, R. L. and Crecelius, S. B., Industrial and Engineering Chemistry, 42(8), 1562–1565, 1950.

Tall oil may replace up to 50% of the rosin normally present in a soluble-matrix type of anti-fouling paint without seriously altering the anti-fouling efficiency or physical stability of the film. Hydrogenated methyl abietate and abietic acid may be substituted for rosin up to 100% with some improvement in physical properties and equal performance as a fouling deterrent. Esters of tall oil produce a marked adverse effect on soluble-matrix paints and is directly proportional to the amount that is substituted. A mixture containing essentially 15% CuO and 85% copper does not quite equal CuO as an anti-fouling pigment.

CALENDAR OF EVENTS

Jan. 13–14. Northwestern Production Club Symposium, Duluth, Minn.

Jan. 15–18. Plant Maintenance Show, Auditorium, Cleveland, Ohio.

Jan. 18–20. Society of Plastics Engineers, National Technical Conference, Statler Hotel, N. Y.

Mar. 5–9. A.S.T.M., Committee Week and Spring Meeting, Netherland Plaza Hotel, Cincinnati, Ohio.

Mar. 7–9. Southern Paint and Varnish Production Club Meeting, Buena Vista Hotel, Biloxi, Miss.

Mar. 13–16. Annual Conference of the National Association of Corrosion Engineers, Hotel Statler, N. Y.

Mar. 16. Fifth Annual Regional Conference, Protective Coatings Div., Chemical Institute of Canada, Royal York Hotel, Toronto, Canada.

April 27–28. Annual Joint Meeting Dallas-Houston Paint and Varnish Production Clubs, Shamrock Hotel, Houston, Texas.

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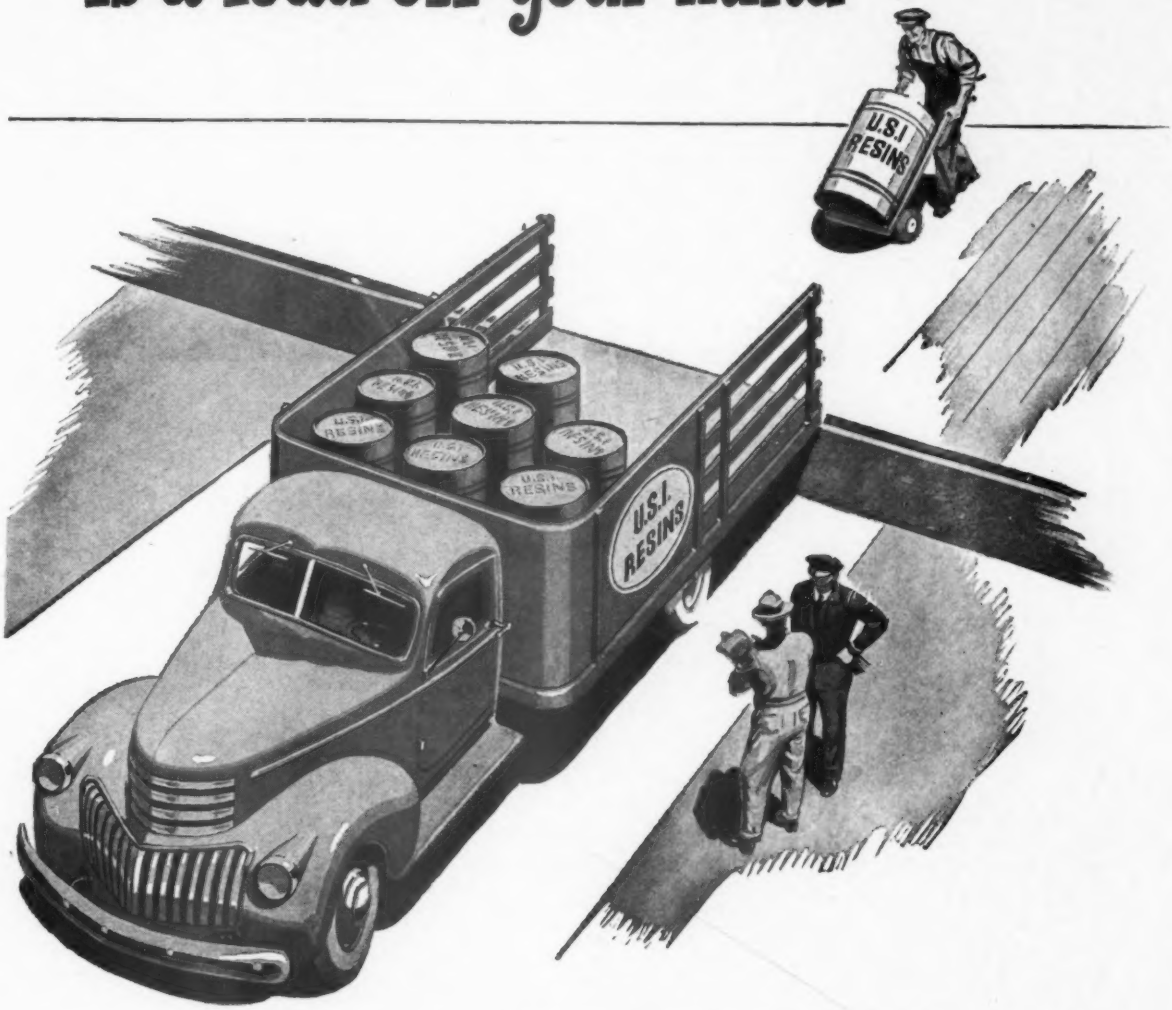

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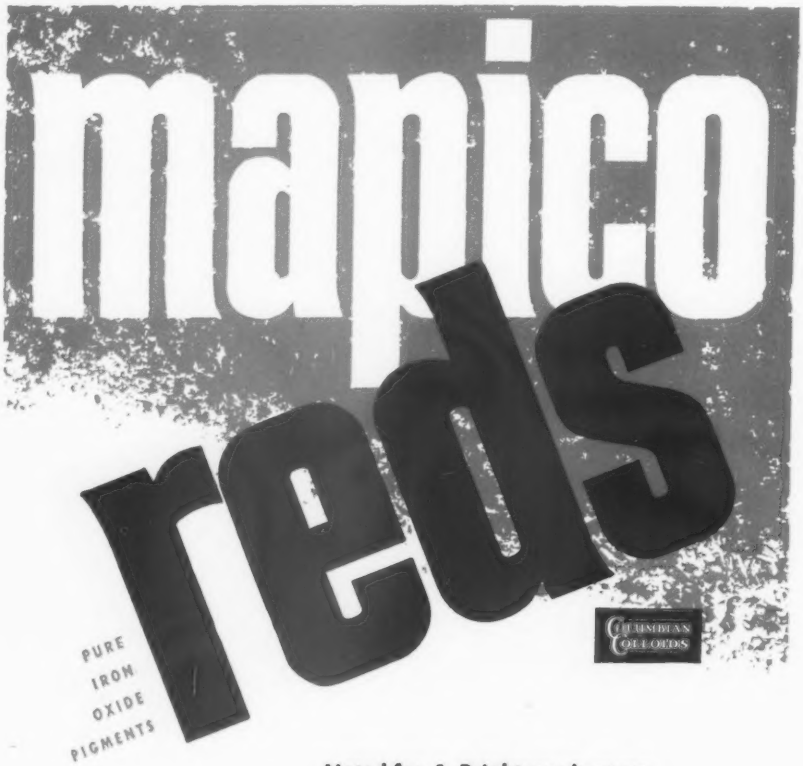

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